Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

GUIDELINES

FOR

CONSTRUCTION AND CLEANUP

OF

ROADS, LEASES, AND SEISMIC LINES

IN

PETROLEUM EXPLORATION AREAS

Petroleum Resources Division

FORT ST. JOHN, BRITISH COLUMBIA

MARCH 1985

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FOREWORD

Since the first edition of these guidelines was published in 1980, both government and industry have seen considerable changes. Changes have occurred not only in the government's approval procedures but also in the techniques of location construction, cleanup and final restoration.

It is the intent of this revision to inform the reader of current approval procedures and construction techniques which will assist in the planning of any petroleum or geothermal-related activity in the province of British Columbia.

I INTRODUCTION

The guidelines are written with the objective of assisting individuals and companies engaged in any petroleum or geothermal-related exploration in the province of British Columbia.

A considerable amount of information is available to assist in planning a location access route. Up-to-date aerial photographs and topographic maps provide a great deal of useful information. Appendix A describes several types of maps, air photographs and information as to where they may be obtained. The Ministry of Energy, Mines and Petroleum Resources District Office at Charlie Lake (604-785-6906) has catalogues available of maps published by the ministry and will provide assistance in obtaining verbal information relating to access into any area in British Columbia. Although the access to any petroleum or geothermal drilling location is under the jurisdiction of the Ministry of Energy, Mines and Petroleum Resources, it is also a concern to various other ministries in the province. For this reason a Government Referral Process has been developed to ensure that all applicable government ministries have the opportunity to express any concerns. The initial contact prior to any petroleum or geothermal activity, including geophysical, is with the Ministry of Energy, Mines and Petroleum Resources at the Charlie Lake District Office which in turn will initiate the referral to the other applicable ministries. This referral system must be completed and approved before any program or construction can be started. The process for obtaining approval to construct is detailed in the next chapter.

These guidelines are organized in the order that the operator would do his actual work, starting with the referral system and ending with the restoration procedures. Also included are six

basic examples illustrating possible construction conditions encountered in British Columbia. The associated access and location construction techniques were developed over a considerable period of time and have been successfully employed.

These guidelines will be updated periodically as better information becomes available.

II THE REFERRAL SYSTEM

Authority for regulation of the oil and gas industry in British Columbia is vested in the Ministry of Energy, Mines and Petroleum Resources. Before commencement of any petroleum, geophysical or geothermal-related activity the operator must contact the District Office in Charlie Lake to complete the referral system.

These activities include any petroleum well, petroleum test hole, geothermal well, geothermal test hole, and any geophysical work. The referral system must also be completed prior to construction of any petroleum or geothermal facility (i.e. oil battery, compressor, etc.), or a campsite.

The referral system applies to all of the above regardless of whether the activity is on Crown land or privately owned land.

A. Petroleum and Geothermal Construction

This procedure applies when approval is required to construct:

a) access and/or a wellsite location;
b) a major facility (i.e. oil battery, compressor, etc.);
c) a campsite other than the drillsite camp.

1) Obtain permission from the Manager Field Operations to survey the location. This may be done verbally by telephoning the District Office.

NOTE: a) On privately owned land the consent of the landowner is required prior to survey.

b) Where access to survey on Crown land is requested using new cut trails or existing trails that have to be snowplowed, the operator will be advised that there may be other land users that may be affected. The operator is responsible for making all necessary contacts.

c) Where the proposed wellsite is on Crown land and there are no existing access trails, access to conduct the initial survey must be via helicopter or all-terrain vehicle.

2) Conduct the survey. The survey must be made under the direct supervision of a British Columbia Land Surveyor and all survey plans must be signed by a valid BCLS. Survey lines are to be cut by hand axe or chainsaw only. The survey plot shall have the ground elevations of the lease corners clearly recorded. All dimensions and calculated number of hectares of any new cut forest on the access, campsite and lease areas are also to be recorded.

NOTE: It is the operator's responsibility to inform the surveyor of the correct lease size.

3) Phone the coordinates of the survey into the Victoria office (604-387-5993) to obtain a Well Authorization number. After receipt of this number the referral process may start. (Applicants for petroleum or geothermal facilities or a campsite are not required to obtain a Well Authorization number).

4) Scout the location and fill out an Initial Impact Questionnaire. These questionnaires are available at the District Office.

5) Complete a sketch plan of the lease layout including campsite location, drill sump location and design (length, width, depth and capacity), flare pit, access into lease, any right-of-way, water course, residence or any other pertinent data.

6) Complete five copies of the access plan on 1:50 000 scale maps. Access routes will indicate width of right-of-way, borrow pit locations and shall be of sufficient coverage to show departure point from the nearest existing vehicular-travelled roadway.

7) Bring the five copies of the access plans, the sketch plan of the lease, the survey plan and the Initial Impact Questionnaire into the District Office.

8) Review the proposal with District Office personnel who will then initiate a Letter of Referral to the other applicable government ministries. If the lease is on privately owned land, the landowner will be included in the referral. If the proposed site is on Crown land the operator will be given an "Application for Crown Land" form, to be taken to the Ministry of Lands, Parks and Housing.

9) Hand deliver the referral letter and maps to all ministries and landowners (if applicable). The regional Fish and Wildlife Branch will supply the names and addresses of any trappers and/or guide outfitters affected. The operator then shall contact these individuals and provide them with a map of the proposed program and expected dates of activity.

10) Return to the District Office with all of the maps and referral letter completed and signed. The District Office will then summarize all comments of each ministry on the referral letter and issue a "Permission to Construct Letter" subject to all concerns outlined in the referral. In the event of a major concern by other signing parties, then a joint inspection and meeting will be planned prior to issuing final approval.

11) Construction may begin after receipt of the "Permission to Construct Letter". On any access where actual grade is constructed it is mandatory that a centre-line survey be conducted. Operators are strongly encouraged to apply for Petroleum Development Road Status on all roads they construct and do not choose to abandon.

B. Geophysical Programs

1) Submit a completed Notice of Commencement of Exploratory Work Form with four copies of the geophysical program on a 1:50 000 Seismic Trail map to the Commissioner of Titles in Victoria (604-387-1908) and one copy to the Manager Field Operations at the Charlie Lake District Office.

2) A project number for the program will then be issued from Victoria.

3) Scout the proposed program and fill out an Initial Impact Questionnaire. These questionnaires are available from the District Office.

4) Bring the completed questionnaire into the District Office.

5) Review the program with District Office personnel who will then initiate a Letter of Referral to the other applicable government ministries.

6) Hand deliver the referral letter to each ministry. The regional Fish and Wildlife Branch will supply the names and addresses of any trappers and/or guide outfitters affected. The operator shall then contact these individuals and provide them with a map of the proposed program and expected dates of activity.

7) Return to the District Office with the Referral Letter completed and signed. The District Office will then summarize all comments of each ministry on the Referral Letter and issue a "Permission to Commence Letter" subject to all concerns outlined in the referral. In the event of a major concern by other signing parties, a joint inspection and meeting will be planned prior to issuing a final approval.

8) Geophysical work may commence after receipt of the "Permission to Commence" letter.

III ROADS AND SEISMIC LINES

All potential access routes, whether road or seismic, temporary or permanent, should be planned prior to the referral process with the aid of recent aerial photographs and topographic maps. This should be followed up by a field inspection to confirm the office interpretation and evaluate any areas of possible concern. Once the route is approved after the referral process, the operator should then flag the proposed route to ensure that there is no deviation. Should there be unexpected construction complications that require deviation, the operator must contact the District Office of the Ministry of Energy, Mines and Petroleum Resources before proceeding. The new route must be approved and may require going through the referral process again.

A. Access Location and Design

Access roads and seismic lines which approach main roads should have a "dog leg" designed into the access to minimize the visual impact (Figure 3-1). This approach is naturally only applicable in forested areas. A permit must be obtained from the Ministry of Highways prior to constructing a road on a public road allowance, or an approach to any existing public road.

When access road and lease construction takes place on agricultural land, the local Ministry of Food and Agriculture will be included in the referral process and will ensure that all access is designed to conserve agricultural land base. The landowner may wish to align roads in a manner facilitating his needs in ease of tillage and weed control and minimal disruption of his property. His concerns must be seriously considered.

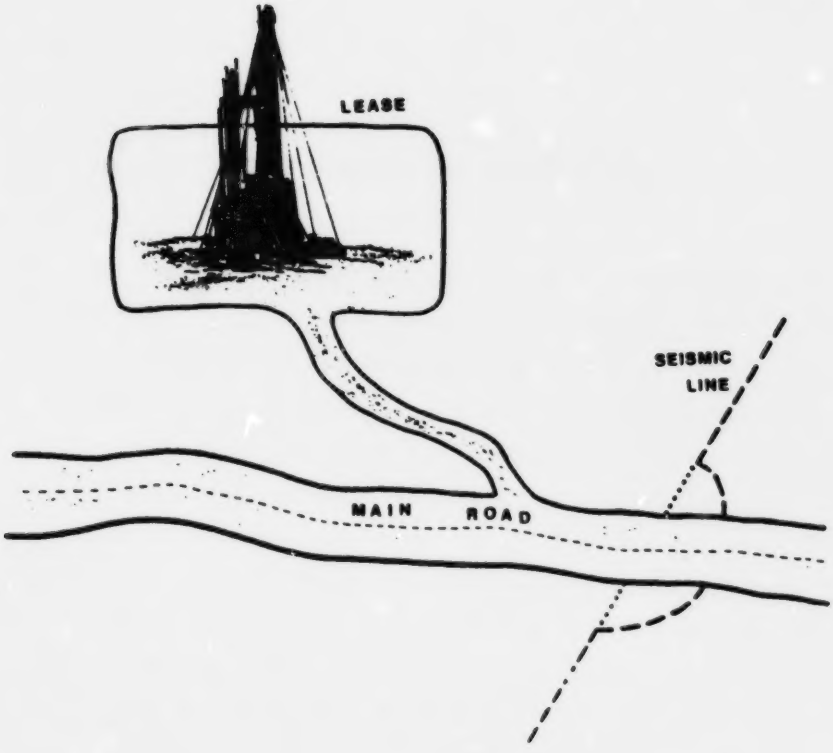


Figure 3-1. Preferred route of access adjacent to a main road.

New cut seismic lines are not permitted closer than 400 metres to a parallel existing line unless permission has been received from the Manager Field Operations at Charlie Lake. Where possible operators are encouraged to use existing lines for their programs.

Road grades should be kept low. Steep grades (greater than eight per cent) often require rig loads to be towed, particularly during rainy or winter conditions. Improved designs may increase the road length but favourably reduce the liklihood of erosion, towing requirements and maintenance costs.

Winter road construction in areas that require cuts and fills will be more susceptible to slumping and instability than summer construction even if the greatest care is taken.

Roadside slumping may be reduced by giving attention to fill slopes during construction. In loose soils, cut banks can be somewhat stabilized by:

1) reducing the slope angle;
2) rounding the tops of cut slopes;
3) falling any trees that may be undercut by erosion;
4) leaving a top dressing of light slash lying over the fill area;
5) immediate seeding and/or mulching to establish vegetation;
6) riprapping, terracing or cribbing.

If the roadslide slope (fill) is severely unstable, to such an extent that erosion occurs from water running off the road surface, then berms may be constructed on the lower side of the road surface to divert water into drainage downspouts. Downspouts should be spaced in sufficient numbers to protect the shoulder and side slopes from erosion. The road surface should be crowned so water is prevented from flowing along the surface before entering the ditches (Figure 3-2). A good drainage system should be constructed as part of the road-building program to control runoff from the road surface (refer to Section B.).

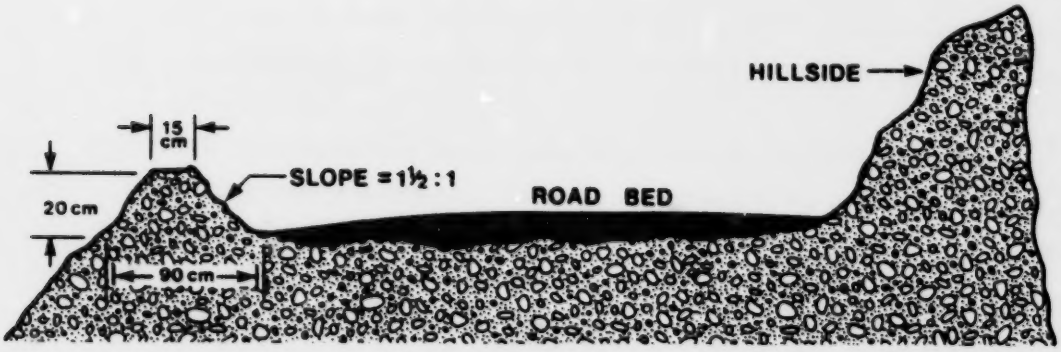


Figure 3-2. Road-shoulder berm for road erosion control.

Groundwater must be controlled so that the base of filled sections does not become saturated. This may necessitate the use of drainage systems, crushed rock and/or perforated pipe. In no case should fill material be placed below the high-water mark of streams. Riprap may be required at the toe of a fill, adjacent to the high-water zone, to protect the fill from erosion during high-water periods.

B. Access Drainage

Drainage design is the most important single element of road layout. Time spent before construction, in identifying the drainage requirement of each section of road and ensuring appropriate machinery and materials are available, will be compensated fully by savings in construction and maintenance costs. Erosion problems caused by poor drainage planning can be extremely difficult to solve and may not be repairable. Drainage systems should be designed with regard to the type of soil in the vicinity of the new road and the maximum expected runoff.

The natural drainage capacity and erodibility of a site depends upon the soil type. Roads constructed through coarse-textured soils with rapid natural drainage capacity will require less extensive drainage control measures than roads through impervious fine-textured materials. Roads crossing slopes with very shallow topsoils will intercept both surface and groundwater runoff. These roads will require a particularly good drainage system so that water cannot concentrate in sufficient quantities to cause erosion problems.

A precise prediction of the maximum runoff volume is a difficult task. Generally high runoff occurs under the following conditions:

1) areas of steep slopes;
2) areas of shallow soils;
3) areas of non-forested vegetation;
4) areas of rapid snow melt (south or west exposures).

If any or all of these conditions are encountered then proper drainage control design is a must. It is often difficult to determine the number of culverts required to achieve good drainage. One might be inclined to think that if water is not being backed up during peak flow periods, spring runoff or heavy rains, then adequate drainage ability has been accomplished and the number of culverts is sufficient. However, there is a great deal more to the problem than simply dispensing with the water so as to protect the road surface from washout. There are three major culvert functions which must be accomplished:

1) to allow passage of water, silt and debris from the upgrade side of the road to the downgrade side, in turn preventing the road from being flooded over and washed out, avoiding saturation of the road bed;

2) to prevent the ditch on the high side of the road from being eroded (proper spacing of culverts);

3) to prevent erosion of the ditch or land on the downslope side of the road (sufficient numbers and proper spacing).

The soil in northeastern British Columbia is so susceptible to erosion that the importance of proper drainage to prevent erosion cannot be overemphasized. Once this erosion starts and goes unchecked it becomes almost impossible to repair the damage.

The key to erosion control is prevention. A rule of thumb which will accomplish this is, "restore the natural drainage, both the volume and route, as near as possible to its original state."

Figure 3-3 illustrates how a road has interrupted the natural drainage (indicated by arrows). Culvert 'A' has been placed in a natural low valley with the road grade rising up the valley on each side of it. An intermittent stream flows through the large diameter culvert 'A' while small diameter culverts b, c, d and e have been placed up the roadway to prevent large volumes of water draining at high velocities. Ditch blocks are also installed

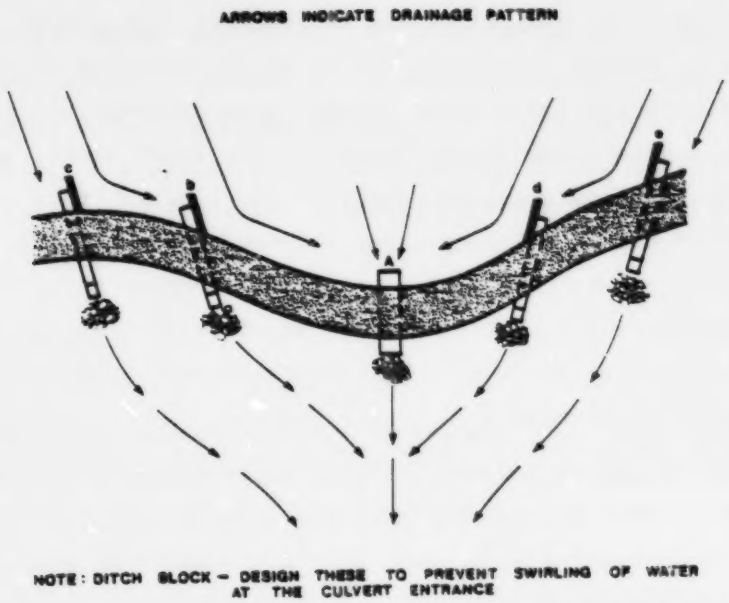


Figure 3-3. Aerial view of a natural drainage path and road drainage design.

to ensure that runoff is caught at the small diameter culverts and drains away. If culverts b, c, d and e were not in place with the ditch blocks then large volumes of water would erode the ditch and probably flood out culvert A, resulting in a road washout.

Finally, to protect the downslope side of the road, a downspout terminating in riprap is on the discharge of each culvert. The end result, as Figure 3-3 illustrates, is an example that follows the rule of restoring the natural drainage as near as possible to its original state.

1. **Installing Culverts** - Care should be taken during installation of even the smallest culvert to ensure that the earth around the unit is compacted. The culvert should be slightly cambered up at the road centre line to allow for settlement of the road due to increased weight of the grade upon the underlying soil (Figure 3-4).

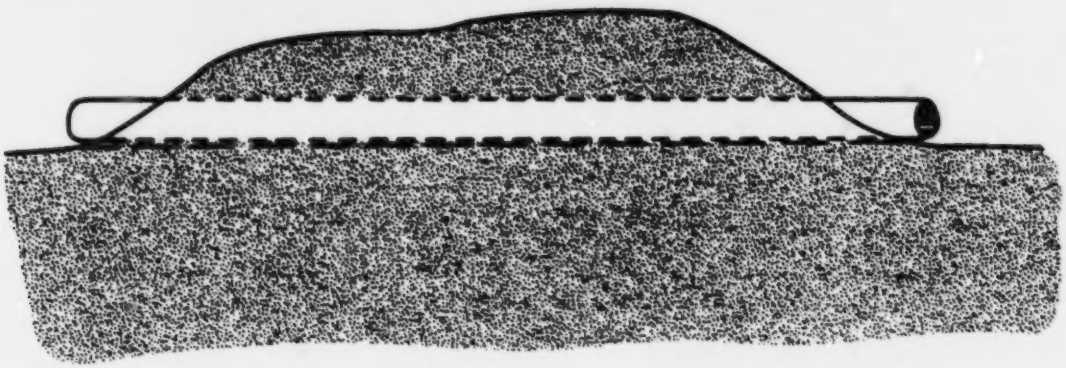


Figure 3-4. Culvert installation as on Figure 3-3, position A. This culvert will be larger than those in b,c,d, or e and will have more fill weight over it. Thus it should be compacted on sides to camber up the middle of the unit. The culvert bottom is very close to the original level and original slope. Both volume and velocity of flow are similar to the original conditions before the road was built.

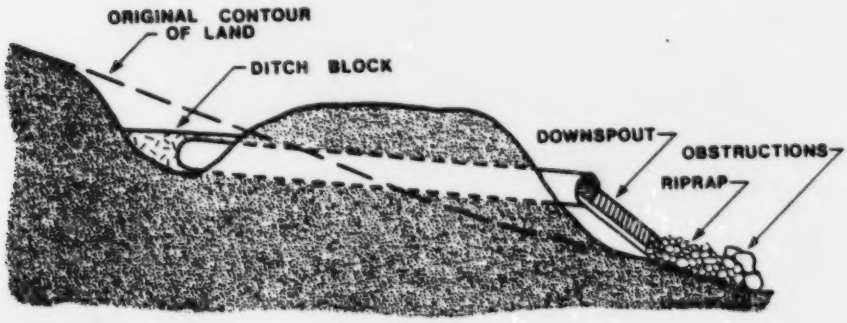


Figure 3-5. Culvert installation as on Figure 3-3, positions b,c,d, and e. Since the downslope portion of this culvert has fill under it which will settle more than the entrance portion which is on cut, it is best not to camber the culvert during installation.

The downstream end of the culvert should be positioned to ensure that the outflow does not cause erosion. Erosion may be prevented by using downspouts at the discharge end of the culverts (Figure 3-5). The earth at either end of culverts can be stabilized with concrete or with hand placed riprap. In turn, undercutting of the culvert and erosion are discouraged.

Culverts should be installed in line with the natural drainage and should have a minimum of one per cent slope so that the velocity of the flow through the culvert will carry silt rather than deposit it in the culvert. A catch basin at the culvert entrance should not be constructed. A catch basin allows water turbulence to be created; consequently, water will erode or undercut the culvert entrance and saturate the road bed. In extreme cases channelling under the culvert right through to the other side has occurred.

The culvert entrance is best located at the bottom of the upgrade ditch so that the ditch is drained completely dry.

The main problem with culverts is that they freeze up and during spring thaw are the cause of washouts unless they can be thawed out. One method that has been used successfully is the use of 57mm (2¼") plastic hose laid inside the culvert (Figure 3-6). The hose is tied up with support stakes when not in use. Whenever water backs up indicating that the culvert is frozen off, the ends of the hose are untied and then lowered to allow water to flow through the hose. This action will speed up the process of thawing out the culvert. At the end of spring runoff the hose is cleared of water and tied back to the support stakes.

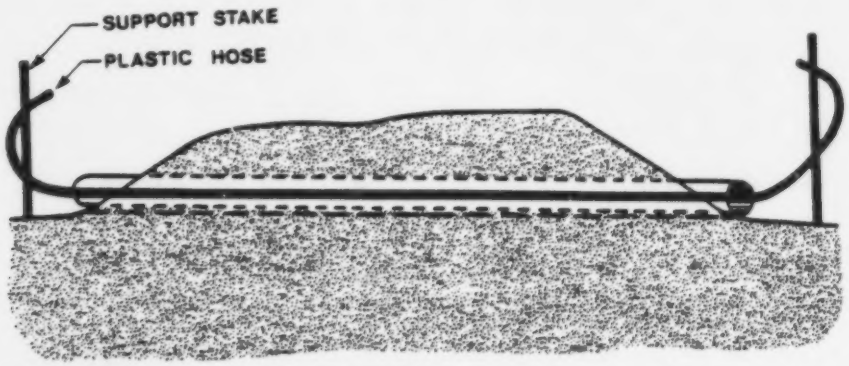


Figure 3-6. Using plastic hose to help thaw out frozen culverts.

2. Use of Riprap and Obstructions - Proper drainage from the culvert is important to ensure that water and silt exit away from the road grade but do not create erosion problems. Depending on the slope of the land, the culvert exit may be flush with original ground level (Figure 3-4) or elevated from the original ground level (Figure 3-5). If the culvert is elevated it will be necessary to use downspouts (½ culvert) and riprap at the end of the downspout. If slash from the road right-of-way is hand placed at the toe of the riprap it can also help to stabilize conditions and prevent erosion at the culvert exit. Other obstructions placed in the path of road drainage systems such as culverts, cross trenches or berms will assist in containing the sediment from these sources (Figure 3-7).

Figure 3-7. Cross drain using obstructions to retard sediment flow.

An obstruction should be installed near an outlet of a cross drain to limit the distance that sediment will move. If the first obstruction is located at the outlet of a cross drain, the protective strip can be comparatively narrow.

Different kinds of obstructions on fills and slopes below fills reduce downward flow of sediment by differing amounts. Obstructions that retard sediment flow, in order of decreasing effectiveness, are:

1) depressions made by pushed-over wind-thrown trees or a wavy ground surface;
2) logs thicker than 10 centimetres;
3) rocks more than 10 centimetres at ground surface;
4) trees and stumps;
5) slash and brush;
6) grass, weeds and shrubs.

C. Environmental Concerns

Where roads are constructed through critical wildlife habitats, there is a loss of habitat, disturbance to animals, and in some instances disruption of natural movements of animals There are three basic types of critical habitat:

1) critical wintering areas;
2) critical reproductive areas (calving, rearing and breeding);
3) critical movement corridors.

Regional Wildlife Biologists of the British Columbia Fish and Wildlife Branch have information as to the location of these habitats. These concerns will be noted in the referral process. Some general considerations to note are:

1) Avoid locating roads on south-facing or west-facing slopes if at all possible. These are frequently critical wintering areas for ungulates.
2) Design cuts and fills so as to not impede wildlife movement.
3) Design roads to provide for easy escape of wildlife from the roadway. This reduces vehicle-wildlife collisions and allows easy escape from road hunters. In areas of high wildlife use, provide escape routes through berm, slash and snow at a minimum of 400-metre spacing.

NOTE: Where roads unavoidably cross critical wildlife habitat the road should be abandoned and reclaimed after it is no longer in use for resource extraction.

Forested land gives mechanical support to the soil, helps prevent slumping and filters drainage water shed from the roadway. Therefore only the minimum areas required should be cleared. To minimize siltation in any aquatic system:

1) Keep right-of-way clearing to a minimum, consistent with road standard requirements.
2) Fell trees away from all water bodies. Pile slash and debris so that it cannot enter water bodies during peak flow.
3) Locate lease sites, campsites and maintenance support sites at least 100 metres from the normal high water mark of water bodies to prevent possible siltation and pollution.

1. **Construction Near and Across Streams** - Where roads or seismic lines are located and constructed immediately beside a stream, side channels of the stream can be cut off. These channels often constitute ideal spawning areas and rearing areas for fry. Right-of-way clearing along side streams can require the removal of trees which provide food and cover for fish. Road embankments which intrude into stream channels can destroy many natural features of good fish habitat. Erosion can be drastically increased, causing heavy stream siltation.

Some guidelines for road construction with respect to streams are:

1) Maintain a buffer zone of undisturbed vegetation between construction areas and all permanent water bodies using the following formula: width of buffer zone M equals 20 metres plus 1.5 times the slope gradient (per cent).

2) Locate borrow pits and temporary roads to borrow pits 100 metres from any permanent water body.
3) Minimize interference with the natural drainage pattern of the land.
4) Keep all fill material out of lakes and streams.
5) Keep heavy equipment out of lakes and streams wherever possible.
6) Avoid soil-sensitive (erodible) areas to minimize possible sediment loading of watercourses.
7) Minimize the number of stream crossings and avoid crossings over gravel fans. Roads which cross gravel fans frequently require channelling to protect bridges and the road bed proper.

Stream crossings should be carefully considered in the planning stage so that problems can be identified and prevented. The stream crossings should not commence until after completion of the referral process, described earlier in Section II.

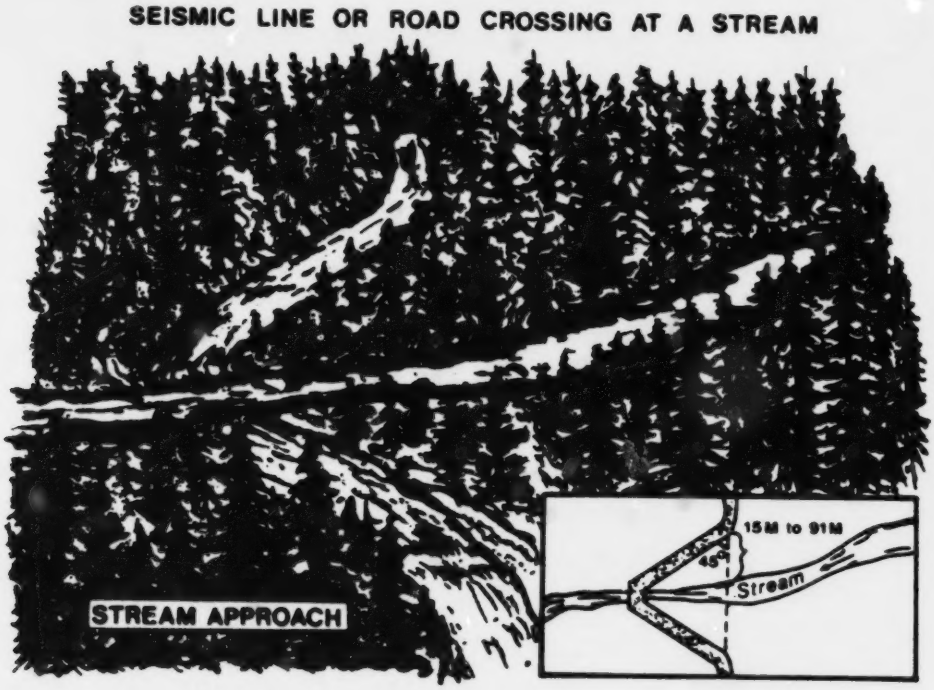
Road and seismic crossings of streams can block fish passage, destroy important fish habitat, and increase stream siltation. Silt is harmful to fish and fish habitat. Since virtually all streams eventually enter fish-bearing waters, all stream crossings must be designed to minimize silt loading. High silt loading can severly deplete one or more years' production of sport fish populations. The harmful affects of silt are summarized as:

1) smothering of eggs, fry and fish food organisms;
2) reduced feeding success of adult fish;
3) reduced light penetration in the water, thereby limiting the production of many fish food organisms.

When crossing streams the following guidelines should be followed:

1) Stream crossing approaches should be constructed as shown in Figure 3-8. (If this were a road then culverts would be installed in the location of the diversion ditches).

2) Ice or snow bridges can usually be used for temporary winter stream crossings, but under no circumstances should earth material, stumps or snags be deposited on the bridge. If full length logs or other structural support material is included in the ice bridge then this must be removed to above the high-water line prior to spring thaw.



NOTE: (1) Diversion ditches along the line.

(2) Immediate entry to stream at 90-degree angle.

(3) If seismic work is to be done within the protective zone, that is both slopes adjacent to stream bed, then hand cutting only is allowed. Stumps cut flush to the ground will also allow vehicles to drive into the area.

Figure 3-8. Seismic line or road crossing at a stream.

3) Fill material to bridges or culverts should not be deposited within the high-water line of a stream. If fill material must extend within the high-water line, cohesive fill material should be used and if necessary protected with riprap. Care should also be taken to prevent culvert plugging. Culvert and bridge failures are a major source of siltation.

4) It is common occurrence for roads to cross streams frequented by beaver. This leads to beaver-caused flooding problems. Also beaver ponds near roads are frequently used as a source of water for drilling operations. In this regard:

   a) If beaver are present contact the nearest office of the Ministry of Environment. A design for beaver proof culverts can be obtained from the Fish and Wildlife Branch.

   b) Water removals from all water bodies require approval from the Water Management Branch of the Ministry of Environment. Authorized removal from a beaver pond during winter will restrict draw-down to not more than 10 centimetres. If more draw-down than this occurs, the beaver could be "frozen out". In most cases the pond inflow will exceed your requirements.

The stream you wish to cross may not have fish in it at any time, however it will have an assortment of organisms living and moving down the system to eventually enter into a fish-bearing stream as fish food. Different types of crossings have different impacts on fish populations and the correct choice of structure will minimize the damage to fishery resources. No matter which type of crossing is built, keep activity in and around watercourses to an absolute minimum.

The life cycle of aquatic organisms is adapted by nature to high silt conditions in the spring runoff season and so will be least affected by a slight increase caused by construction during this period. High-flow rates tend to flush sediment from gravel spawning areas.

Construction later in the summer can be highly detrimental since these same organisms are adapted to conditions of clear water. Also the flow rates are low and have little capability of flushing large sediment loads from the stream bed. Any construction in and around a stream channel will require careful supervision to ensure that debris, fill or soil are not inadvertently pushed into the water or below the high-water line.

For more detailed information on water crossings the following reports are recommended:

Environmental Objectives and Procedures for Water Crossings prepared by the Ministry of Environment. A Study on Pipeline Water Crossing Methods prepared for the Canadian Petroleum Association. Addresses for each of these publications are included in Appendix D.

If the operator wishes to remove gravel from a stream on Crown land then he should plot the gravel source on a 1:50 000 series, Seismic and Trail Data map. Bring this map to the regional Lands, Parks and Housing Ministry, where a permit to remove gravel can be obtained. If the gravel is located in or nearby any stream, then the operator will be referred to the area Fish and Wildlife Branch.

When a permit is issued to remove gravel from or close to any stream, the following conditions should be observed:

1) All operations are to be conducted behind the protection of a dyke or berm separating the work area from the flowing stream. Upon completion of the

project the dyke should be removed and the area of operations smoothed with a slope toward the river, leaving no depressions in which fish may be trapped by varying flows.

2) If the excavation is large and deep with no possibility of levelling to stream grade, stream flow should be provided through the area at all discharge levels.
3) All excavated overburden debris and brush should be removed above the limits of high water.
4) Stream crossings should be made via bridging or confined to one point only.

Stream channelling for flood control, road construction or protection of bridge abutments can have the same effects as gravel removal. Deposition of disturbed gravels may change the lateral stability of the stream in its flood plain. Bank undercutting occurs and snags fall into the water. Channelling reduces the total width of a stream, increases stream velocities, and can prevent fish passage. Containment of streams may be achieved by dyking near the banks rather than by channeling. If it is necessary that a section of stream be channeled then the operator must contact the area Fish and Wildlife Branch. They in turn will advise if the stream contains fish and the least harmful time in which to channel the stream.

2. Seismic Construction - Seismic construction generally has less impact upon wildlife than does more conventional vehicle road construction. Several points that have not been mentioned yet and must be considered are:

1) Minimize all vegetation disturbance. This is particularly applicable in alpine and subalpine areas as well as near any stream or river crossing.
2) Avoid sidecuts on hillsides as much as possible. These can impede animal movement.

3) Do not pile slash or earth material so as to block animal movement. If slash is to be left there, alternate slash piles on either side of the line. No slash pile should be more than 100 metres in length.

For more detailed information on seismic line construction, slashing and erosion control, refer to the "Licence to Cut Timber" in Appendix B.

3. Garbage and Sewage - There are a variety of government agencies directly and indirectly involved with garbage and sewage disposal.

NOTE: The best way to meet all these agencies is to make garbage available to attract bears - So Don't!

a) Garbage - Generally a small camp having less than 10 occupants and which is used seven days or less may simply bury its garbage with at least one metre of fill. All garbage should be burned before burial, to deter bears. Camps or worksites which have more than 10 occupants or will be in place longer than seven days must meet the following requirements:

1) Incinerate all garbage in a closed-chamber fuel/air-assisted incinerator on a daily basis.
2) Haul the burned remains of the incinerator away from the camp and work area, to an approved garbage pit.
3) Fill the garbage pit with at least one metre of fill when the site is abandoned.

b) Sewage - Temporary campsites may use a pit disposal. The pit must be at least 60 metres from any natural body of water and at least one metre above the ground-water table.

Sewage systems which are expected to be in use for several months will require consultation with the Ministry of Health and the Waste Management Branch.

4. Other Land Users - Virtually all of British Columbia is covered by registered traplines. The personal income of trappers can be adversely affected by the activities of seismic crews, drilling or road construction. In the past trappers have sought and received compensation for damage to trails, traps and the moving of traps to accommodate the petroleum industry. It is important to establish contact with the trapper early enough to allow him sufficient time to establish alternate trap and trail locations. If contact is not made early, snow depths may prevent him from developing alternate lines and result in a loss of income for the remainder of the season. Where roads or seismic lines intercept trapline trails, it is important to provide easy access across the road or line.

Guide outfitters can also be adversely affected by petroleum activity. Early contact with the guide outfitter is also essential to allow proper planning of his business.

In each of these cases during the referral process the area Fish and Wildlife Branch will supply the names and addresses of trappers or guide outfitters that may be affected by a proposed program.

IV LEASE CONSTRUCTION

To comply with existing regulations there are numerous basic requirements to be satisfied during all aspects of well drilling. It follows that planning with these requirements in mind is imperative. This section has been compiled to assist all operators in planning their activities.

A. Planning the Lease Site

In planning a lease site the three primary principles to consider are:

1) safety of rig personnel and of associated personnel (stability of the rig foundation, relative location of camp, sump, flare pit, electrical supply cords, access to camp and lease);
2) protection of the environment (surface water, ground water, streams, erosion control, restoration of the lease, containment of drilling fluids during drilling and after cleanup of lease);
3) combining the first two principles in the most economical manner possible by proper planning.

Since each lease will vary from the environmental standpoint regarding surface soil, vegetation, original contour, surface drainage and many other variables, it follows that individual solutions will have to be designed to meet specific location conditions. The following is a list of considerations during the planning stage.

1. Topsoil - For the purpose of the oil industry topsoil should be considered as the top layer of any soil, minimum

of 25 to 30 centimetres deep regardless of its physical properties. When constructing a lease this top layer should be stripped off and piled separately. The purpose is to ensure that this topsoil is available for final restoration. If the soil is not saved the end result is a restored lease that may not support vegetation growth as well as the surrounding area. This is of extreme importance on present and potential agricultural land.

2. **Drilling Sumps and Wash Water Pits** - The drilling sump is best located on the high side of the lease or if a remote sump is used, then in an elevated area. This will help to ensure that the natural runoff is away from the sump. For on-site or remote drilling sumps the following applies:

1) The sump area is to be tested before construction by either a backhoe or drill to ensure that it is located in impervious soil (clay) and will not intercept the groundwater table. If a pervious material or groundwater is encountered when excavating a sump, the Charlie Lake District Office must be notified. It is generally not permitted to put a clay fill over a pervious material.
2) There must be a sufficient area adjacent to the drilling sump to facilitate containment of the disposed fluids or an area suitable for surface disposal by irrigation of treated fluids.

Whenever a drill sump is planned to be treated and pumped off for disposal then a wash water pit is to be constructed on the lease site. The purpose of this pit is to collect all rigwash fluid and other drainage from around the substructure and isolate it from the drill fluids stored in the main sump. The reason for

this is simply that the fluids drained around the substructure are a source of contaminants that are not easily treated and therefore must be kept separated from the drill fluids.

Various methods have been employed to gather the wash water and divert it to the wash water pit. One of the most successful methods involves contouring the area around the rig substructure so all drainage is collected in the cellar made up of a 2.44-metre-diameter culvert. A 25.4-centimetre culvert then drains the fluid into the washpit (Figure 4-1). During winter conditions hot water circulating lines can be used to keep the fluids from freezing up.

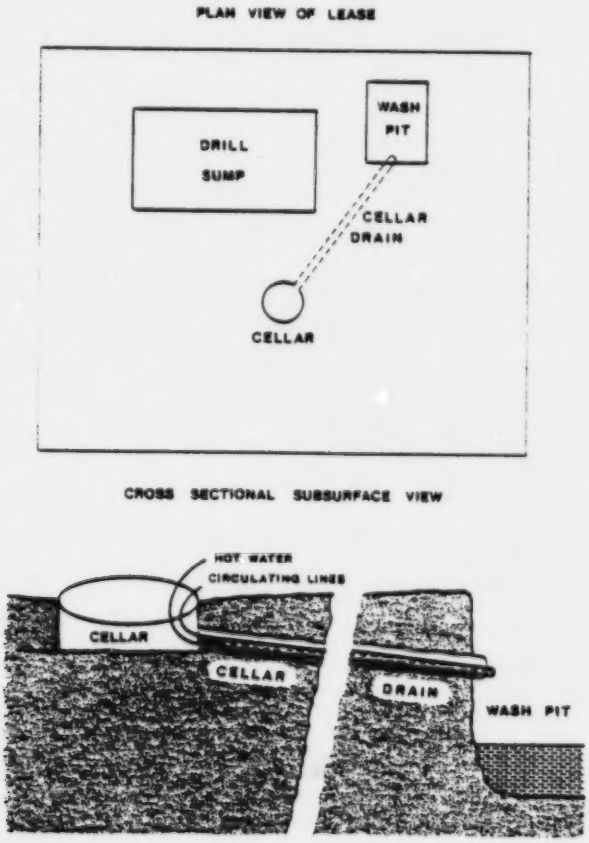


Figure 4-1. Wash water pit design.

3. **Borrow Pits** - Borrow pits are used to obtain fill material to construct the lease road or lease pad. Wherever possible existing borrow sites should be used. Development of new pits should be planned and located before construction and included in the proposal submission when the referral process is initiated.

Before clearing a borrow pit area, test holes should be excavated with either a backhoe or drill to check suitability of material and groundwater level. Upon termination of use, any borrow pit located on Crown land must be properly sloped (3:1), all slash disposed of and the cleared area seeded to B.C. Forest Service mix.

NOTE: A borrow pit must never be used to dispose drilling fluids or as a remote sump.

4. **Trailer Placement** - Plan the placement of the rig manager's trailer, geologist's trailer and other such enclosures. They must be located at least 80 metres from the wellbore and flare pit.

B. Lease Size

The question of what size of lease to construct including the campsite is governed by the depth of hole, the number of days drilling and the size and location of sump required. It is important that the operator makes every attempt to secure a drilling rig contract before the referral system is started. There have been cases in the past where the rig waits racked at the lease entrance while further approvals to enlarge the lease are processed, all because the lease was built for a smaller rig.

Table 1 shows some general sizes for lease construction for the operator to consider.

TABLE 1 SUGGESTED LEASE DIMENSIONS

Projected Hole Depth	Estimated Drilling Time	Lease Size	Sump Capacity Including 1m Freeboard	Camp Size
To 1850m	15 days	120m x 130m	$2670m^3$	30 x 60m
1850-3000m	16-90 days	125m x 135m	$2670 - 3570m^3$	40 x 70m
3000-5000m	91-250 days	140m x 150m	$3570 - 5100m^3$	60 x 100m

These are only guidelines and each location will have to be handled individually as the situation warrants. Generally the sump capacity will dictate the size of the lease. Other factors that will affect the final decision are:

1) if the hole is directionally drilled then as a rule the sump is generally 30 per cent larger, and
2) if drilling near the foothills and penetration rates are slow, the drilling time may be double that of the same depth hole on the plains.

Figure 4-2 illustrates a method of estimating the sump capacity in relation to the hole depth. To obtain your total sump capacity required, add one metre to the sump depth for the required freeboard.

C. Lease Arrangement

Figure 4-3 illustrates a typical lease and campsite configuration as found in northeastern British Columbia. Regulatory requirements must be met on each location to ensure that:

1) The flare pit is 50 metres from the well centre and 80 metres from any public road or buildings (Figure 4-4). The flare pit should be excavated to a depth of not less than two metres. The side and back walls must be at least two metres above ground level and constructed to resist erosion by high pressure flow.

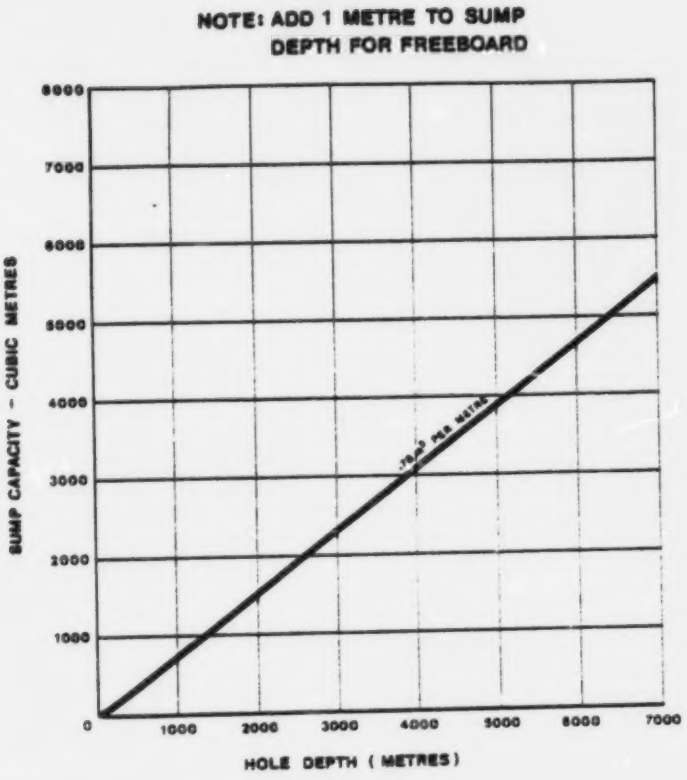


Figure 4-2. Sump Volume Chart.

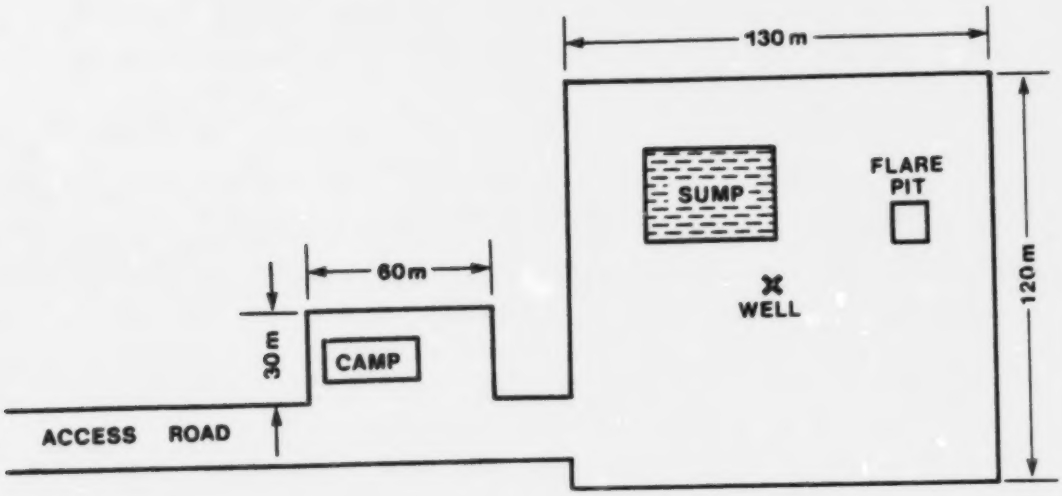


Figure 4-3. Typical lease and campsite arrangement.

2) Trailers of any sort containing sleeping facilities (cots, beds, bunks, chesterfields, etc.) are located at least 80 metres away from the flare pit (Figure 4-4).

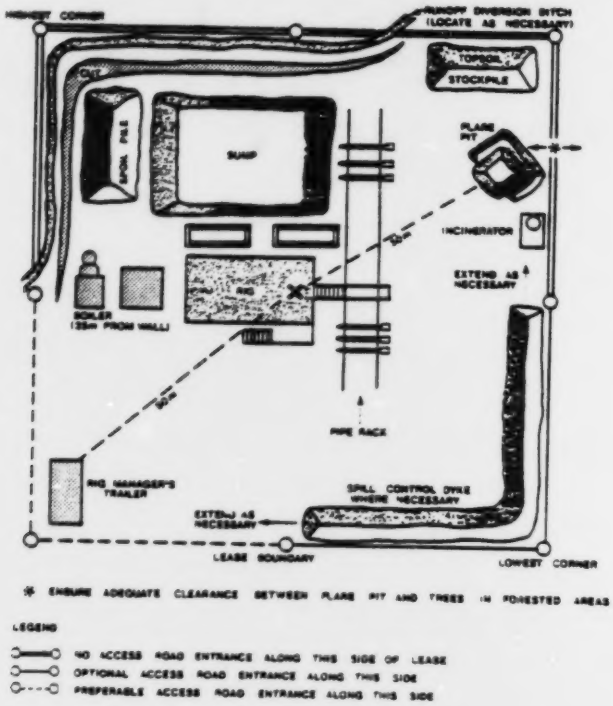


Figure 4-4. Typical lease layout. Note runoff diversion ditch in cut side.

Also plan to locate the access road and campsite on the opposite side of the lease in relation to the flare pit, as illustrated in Figure 4-3. This will ensure that in an emergency the lease and campsite can be abandoned safely without exiting by the flare pit. Where possible the campsite should also be located at a higher elevation and upwind of the lease site.

As the majority of seismic lines are potential winter access roads, the operator should consider offsetting any well centres back 15-30 metres from the middle of the line. This would reduce the liklihood of a vehicular collision with the wellhead at a future date.

D. Drainage Design

It is necessary when planning a location to consider the drainage on and around the lease site. There are two requirements in this respect:

1) To ensure that all fluids associated with the drilling operations drain into the drill sump and,
2) To ensure that any runoff from the surrounding area does not drain onto the lease and subsequently into the drill sump.

To accomplish this the lease should be contoured so that the area beneath the rig slopes towards the sump (Figures 4-5 and 4-6). Runoff diversion ditches should be constructed on the high side of the lease to intercept all runoff water and divert it off lease away from the drill sump (Figures 4-5 and 4-6). This last point is extremely important as it avoids the possibility of a drill sump overflowing during spring runoff or periods of high precipitation.

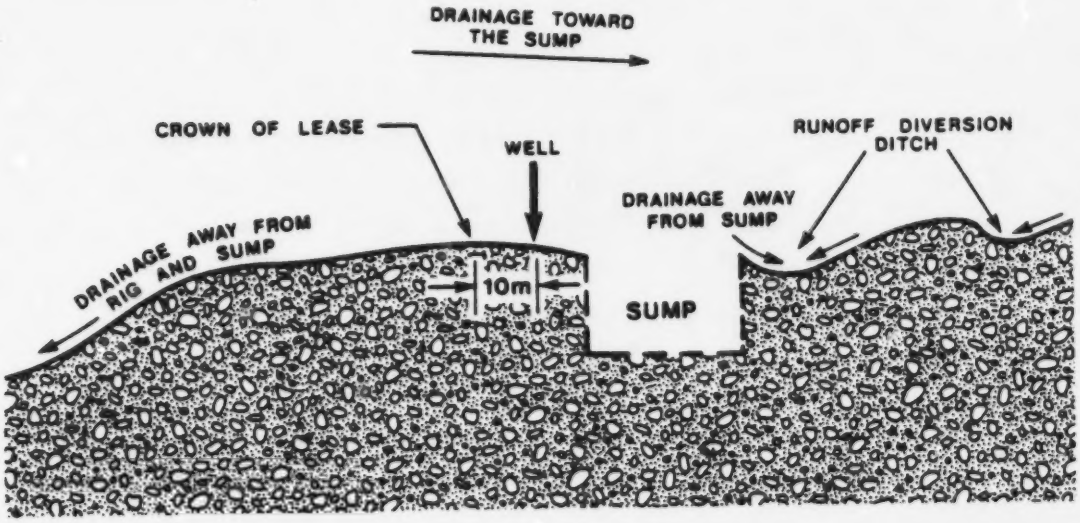


Figure 4-5. Cross sectional view illustrating proper drainage on lease area.

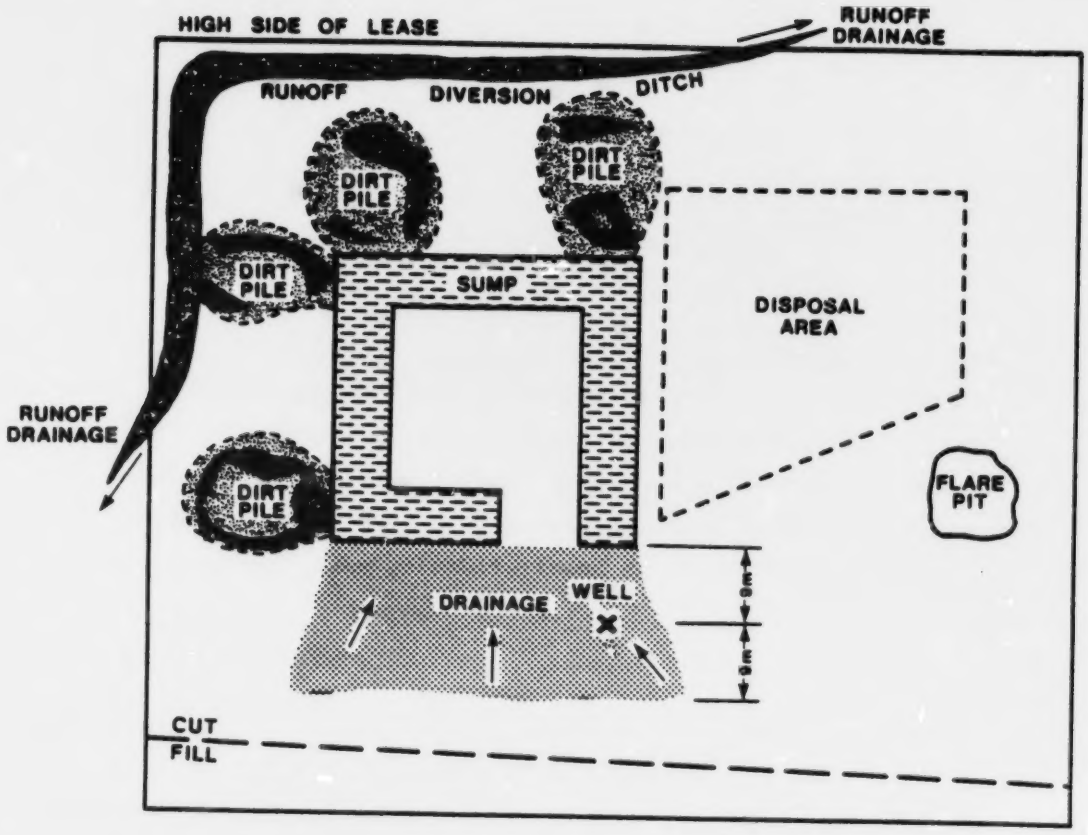


Figure 4-6. Plan view illustrating proper drainage on lease area.

V CONSTRUCTION EXAMPLES

This section is devoted to actual construction examples typically encountered in British Columbia and the procedure to follow prior to construction. In all cases it should be noted that all wellsite locations are to be properly identified with a well location sign at the entrance to the lease. This requirement is over and above the wellsite survey stake generally found at the well centre.

A. Sidehill Locations

Conditions:
a) Location slope of five metres in 120 metres.
b) Clay soil, small trees on lease. If this land were ever developed it would be range land, not suitable for cereal crops.
c) Projected well depth of 1850 metres.

Procedure:
1) Complete the referral process.
2) Install a well sign at the entrance to the lease.
3) Ensure that there is sufficient space in the cut area of the lease to construct the sump and accommodate sump fluid disposal as illustrated in Figure 5-1.

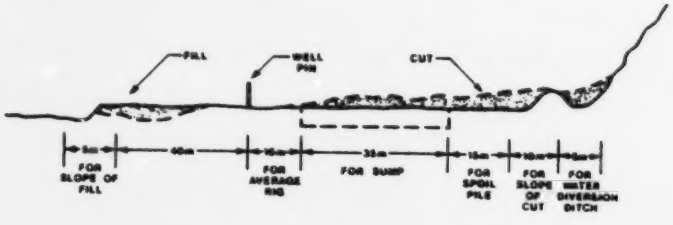


Figure 5-1. Example A-type lease with approximate dimensions within the lease area.

4) Strip the lease of any trees for total disposal by burning. A burning permit must be obtained from the Forest Service.

5) Strip the top 25 centimetres of soil off the lease area and pile separately from the subsoil pile.

6) Start the lease levelling operation by making the cut as indicated in Figure 5-1. Contouring for proper drainage is done at this time.

7) Construct water runoff diversion ditches and/or berms to divert runoff water from the lease (Figure 4-5).

8) Construct the sump as indicated in the lease plan submitted earlier to the District Office during the referral.

B. Flat Arable Land

Conditions:
a) Almost flat terrain, arable land.
b) Topsoil to depth of 15 centimetres, subsoil impervious clay.
c) Projected well depth of 1850 metres.

Procedure:
1) Complete the referral process. If the land is privately owned and/or in the Agricultural Land Reserve, the landowner and the Ministry of Agriculture will be included in the referral process.
2) Install a well sign at the lease entrance.
3) Strip the topsoil from the lease and pile it separately from the subsoil pile so that it can be used for final restoration.

NOTE: In the event the location is not abandoned then the location of the topsoil should be recorded for future reference.

4) Construct the sump as indicated in the lease plan submitted earlier to the District Office during the referral process.

5) Locate the campsite adjacent to access road. The access road should be aligned to cause the least possible disruption of farming operations.

C. Muskeg Conditions

Muskeg by definition is an area of insufficient drainage, generally clay over which moss has accumulated. This layer of moss varies from a few centimetres thick in some areas to ten metres or more in other areas.

There are two methods of lease construction which are commonly used in British Columbia. Examples of both will be discussed here. In either case a borrow pit will be required to obtain material to pad the lease (see page 32).

1. Stripping Muskeg Layer Off

Conditions:

a) Winter.

b) Muskeg layer to a depth of less than one metre.

c) Sparse tree cover.

d) Projected well depth of 1850 metres.

Procedure:

1) Complete the referral process.

2) Install a well sign at the entrance to the lease.

3) Remove muskeg layer from an area 45 metres x 63 metres (Figure 5-2).

4) Construct the sump to the size approved during the referral process, in this example 27m x 18m x 3.85m (these measurements are

for straight cut ends. If the ends are sloped then size would have to be increased accordingly).

5) It is advisable to obtain approval to construct a sump disposal area adjacent to the drill sump (Figure 5-2). If this is done during construction then the ground will not be frozen, resulting in a saving during cleanup. A berm of at least two metres should be left in place between the sump and disposal area.

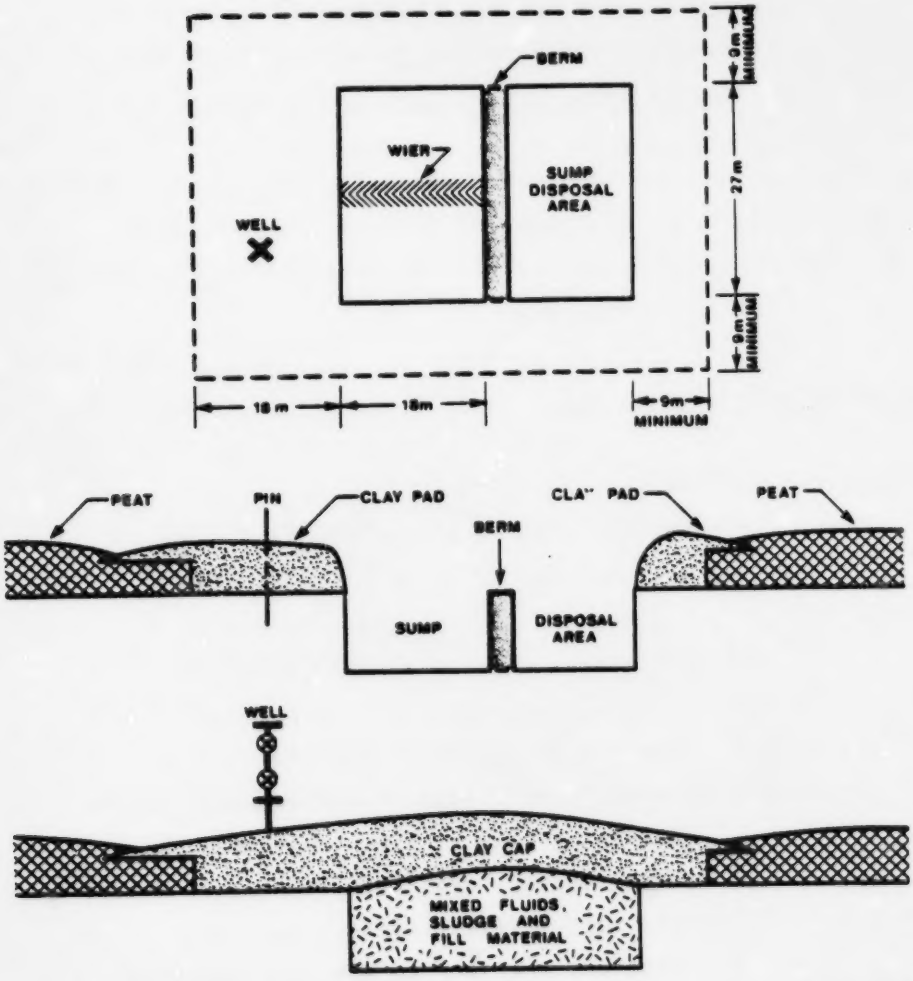


Figure 5-2. Constructing and cleaning up a lease where a permeable layer of material is stripped off.

6) Pad the lease area (45m x 63m) to a level slightly higher than the original elevation. It may be advantageous to use the dirt excavated from the sumps.

7) To avoid possible problems of the rig settling, it is very important to protect the pad from fluids. This can be accomplished by ensuring that the drainage around the rig is sloped towards the sump and then laying down plastic sheets underneath the matting. Cribbing should be installed in the cellar along with chutes on the mud tanks.

2. Leaving Muskeg Layer in Place

Conditions:

a) Winter.
b) Muskeg layer is too deep to strip away (generally greater than one metre deep).
c) Sparse tree cover.
d) Projected well depth of 1850 metres.
e) Remote sump will be required (see page 30).
f) A borrow pit will be required (see page 32).

Procedure:

1) Complete the referral system.
2) Install a well sign at the lease entrance.
3) Compact the snow on the lease site to accelerate frost penetration and then blade off the excess snow.
4) Construct the borrow pit and remote sump as approved in the referral process.
5) Construct the clay pad (the operator may wish to use geotextiles as a base for the pad). It may have to be as much as 1.5 metres thick to support a rig. The pad thickness

should be built up, a layer of about 30 centimetres at a time, until the desired thickness is attained. This will yield good compaction along with good frost penetration.

6) Contour the pad as in Figure 5-3.

7) As in the previous example it is advisable to lay plastic sheets under the rig matting, install chutes on the rig tanks and a cribbed cellar (Figure 5-3) with a cemented bottom.

8) If a catch pit is used instead of tanks, then it should be lined with not less than 30 centimetres of clay.

NOTE: When a catch pit receives only small quantities of fluid during winter conditions, it will freeze before the vacuum truck can remove the fluid. This is particularly the case with a catch pit that is too large. A typical catch pit is 15 metres x 4 metres x 0.6 metre deep.

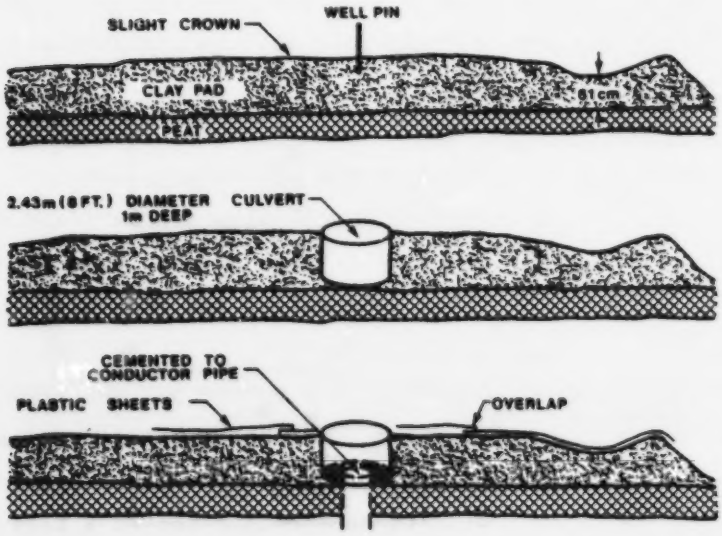


Figure 5-3. Three steps of constructing a pad with catch pit over a permeable material.

D. Areas of Pervious Material

Conditions: a) Pervious material consisting of sand or gravel.

b) Projected well depth of 1850 metres.

Procedure: 1) Complete the referral process.

2) Install a well sign at the lease entrance.

3) If the pervious material is sufficiently shallow to allow it being stripped off then proceed as in previous Example C1.

4) If the pervious layer is too deep to permit stripping away, then a remote disposal sump will be required. Every effort must be made to collect all the drilling fluids in tanks to be hauled to the remote sump. One system that has been used with good results is illustrated in Figure 5-4.

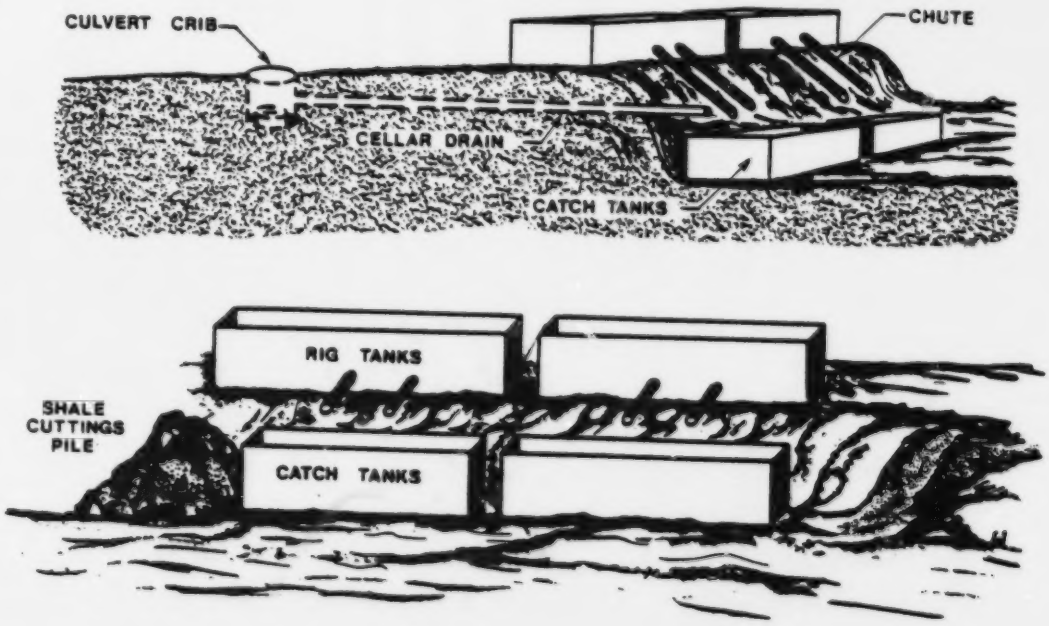


Figure 5-4. An effective fluid containment system used in gravel leases.

5) Contour the lease for proper drainage and runoff control.

6) Construct a scoop out in which the catch tanks will be placed. It must be deep enough so that a vacuum truck can drive alongside and load up. Since disposal would not be allowed on this lease, the catch tanks could be located on the low side of the lease if the operator so desired.

7) Put the catch tanks in place and use steel culvert (or equivalent) chutes so arranged and secured to ensure that all fluids dumped from the tanks are caught in the catch tanks.

8) Use plastic sheets overlapped and carefully arranged under the rig matting.

9) Any fluids from the rig matting drain into the cribbed cellar which is cemented to the conductor pipe and is drained as illustrated on Figure 5-4 into the catch tanks (or vacuumed out of the cellar with a vacuum truck if no cellar drain is used).

10) During winter the shale pile should be kept thawed (by steam hose) and hauled to the disposal area.

NOTE: There have been several types of designs used successfully to keep the fluids off the lease. The use of liners, both plastic and cement, have been tried as well as cementing the entire drainage area surrounding the rig. All fluids around the rig and from the rig tank drain across cement into the catch pits. Drainage under the rig is contained with plastic sheets and sealed cribbing.

No matter what technique is used, every effort to minimize fluid loss to the pervious base should be taken.

E. Mountainous Regions

Problems associated with mountainous regions are so site-specific that it is not possible to typify a construction procedure as an example.

Operators will be expected to flag the proposed access route and lease site as well as arrange transportation for a field inspection when submitting the referral. Representatives from at least three ministries will likely wish to take part in this inspection. In the more sensitive areas the operator will be required to have a geotechnical engineering evaluation of the proposed access and lease site areas, providing recommendations for construction and cleanup procedures.

General comments concerning alpine and subalpine areas:

1) At altitudes approaching 1100 metres the ground vegetation consists of mosses, various lichen, and other slow-growing vegetation. None of these consume or require much by way of nutrients (even in their peak growing season) and are dormant for nine months of the year.
2) It takes hundreds of years to produce an alpine vegetation groundmat over 30 centimetres deep. Heavy annual precipitation keeps this mat saturated constantly.
3) The slopes encountered in alpine areas cause fluids to migrate rapidly to active watercourses common in alpine areas.
4) Although there are trees growing in alpine areas above 900 metres they grow very slowly and consume relatively small amounts of nutrients compared to vegetation under cultivation or trees at the 600 metre level.

5) Because of the above conditions, sump fluid disposal by pump-off is not recommended in alpine areas above the treeline.

6) In both alpine and subalpine areas it is often difficult to find impervious material to contain sump fluids on the lease and thus requires locating a remote sump.

F. Permafrost

Permafrost by definition is simply permanently frozen ground, which does occur in some areas of northeast British Columbia. At the time of this writing the thickest layer encountered on a lease was eight metres, but usually it has been two metres or less. It is recognizable by layers of stringers of crystal-clear ice, and because of this it naturally loses volume (as much as 60 per cent) when thawed out. The obvious problem with setting a drilling rig on permafrost is keeping the permafrost from melting beneath the rig and around the well bore. The two construction methods commonly used are:

1) Strip off the permafrost layer and proceed as in example C1 where a layer of one metre or less is removed and a padded lease is constructed. In the past, permafrost has proven to be extremely hard and thus slow and expensive to rip up (has been drilled and blasted).

2) Proceed as in example C2 where a lease pad is constructed on top of the permafrost.

VI PROCEDURES FOR LEASE CLEANUP APPROVAL

Before submitting a cleanup proposal, a sump fluid chemical analysis and fish bio-assay test must be performed on all drill sumps by a recognized commercial laboratory. A copy of the analysis report must be in the possession of the District Office prior to notification of intention for restoration, and only then will disposal procedures be given approval.

A. Sump Fluid Samples

Since sump fluids will tend to stratify, a method is required to ensure that operators obtain a uniform composite sample. All sampling of sump fluids or other oilfield waste fluids must be conducted in the following manner:

1) Divide the sump into six equal segments and obtain a core sample of the fluid and sludge at the bottom of the sump.

2) A core sample is obtained by holding a length of clean pipe vertically above the fluid and then lowering the pipe to the bottom of the sump.

   Push the pipe into the mud so as to form a plug in the pipe; 38mm (1½") plastic pipe has been used successfully.

   Pull the pipe to surface and empty the contents into a clean pail.

3) Collect a sample from each of the six segments, and then transfer the fluid into clean plastic containers (approximately four litres volume). Use opaque containers if such are available.

4) The samples should be kept from freezing and transported to a reputable laboratory for analysis as soon as possible.

During winter, sump samples should be obtained at the time of rig release before the sump has frozen.

A sketch of the sump showing dimensions, sample points and sample point depths must accompany each fluid sample taken to the laboratory (Figure 6-1).

COMPANY:
WELL NAME:
LOCATION:
SAMPLING COMPANY:
NAME OF SAMPLER:
DATE SAMPLED:

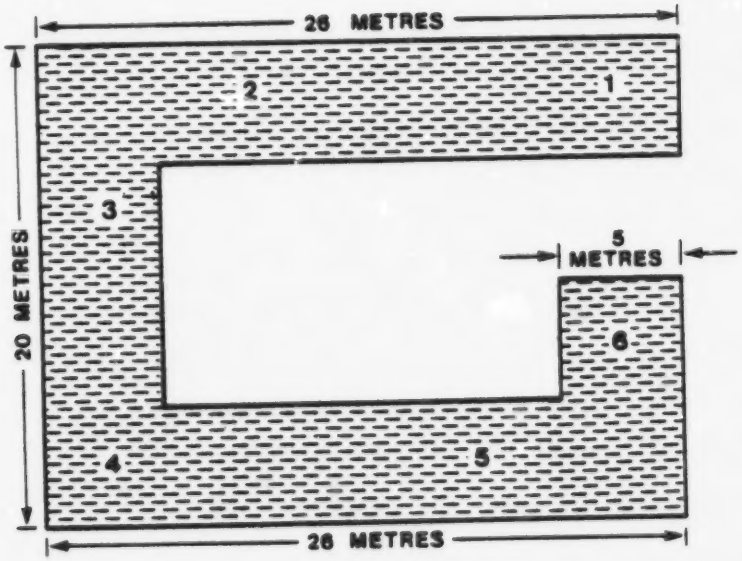


Figure 6-1. Sump sample sketch.

The sampling sketch is to be submitted to the District Office as part of the analytical report. The laboratory is to conduct the following analysis:

B.C. SUMP ANALYSIS (CHEMISTRY)

HYDROCARBONS:	
TOTAL SUSPENDED SOLIDS:	g/m^3
pH @ 20°C:	
CHLORIDE:	g/m^3
SULPHATE:	"
SODIUM:	"
POTASSIUM:	"
CALCIUM:	"
MAGNESIUM:	"
TOTAL DISSOLVED SOLIDS:	g/m^3 DRIED @ 105°C
	" IGNITED @ 550°C
CONDUCTIVITY	MILLISIEMENS/METER @ 25°C
SODIUM ADSORPTION RATIO:	

EXTRACTABLE TRACE METALS

BORON:	g/m^3
MERCURY:	"
ARSENIC:	"
SELENIUM:	"
ALUMINUM:	"
BARIUM:	"
CADMIUM:	"
COPPER:	"
CHROMIUM:	"
MANGANESE:	"
NICKEL:	"
LEAD:	"
VANADIUM:	"
ZINC:	"
SILVER:	"

FISH BIO-ASSAY: 96-HOUR TEST

B. Sump Fluid Disposal By Pump-Off

There are cases where the operator may wish to dispose of drilling fluids by pumping them off onto the surrounding area. This is particularly the case for larger sumps which do not have enough lease area for conventional restoration methods. Prior to any type of surface disposal the following steps must be completed:

1) The operator must contact the District Office and present a proposal of his intentions.
2) A sump sample is to be taken by the method outlined previously and the District Office is to be notified 24 hours in advance so the sampling can be witnessed.
3) The area of disposal is to be pointed out at the time of sampling.
4) The sample must meet the following standards for surface disposal:

Hydrocarbon	nil
Total Suspended Solids (flexible)	50 g/m^3
pH @ 20°C	5.5 - 8.5
Chloride	3000 maximum g/m^3
Sulphate	2000 g/m^3
Potassium	1100 g/m^3
Calcium	500 g/m^3
Magnesium	1500 g/m^3
Total Dissolved Solids	4000 g/m^3
Sodium Adsportion Ratio	20
Fish Bio-assay	96-Hour Test with 100% Survival

If the sump fluid sample does not meet the above requirements then the sump will have to be treated and steps 2, 3 and 4 repeated. Once the sample is within the standards the operator must then obtain written permission from the District Office. Permission to pump-off will be subject to the following conditions:

1) Written consent from the landowner must be presented to this office before spraying any fluid on private land.

2) The chloride concentration must be determined on site, at the start of pumping, and each 30cm sump depth thereafter.

3) The fluid must be dispersed in such a manner that the chloride load does not exceed the following:

448.3 Kg/HA (400 lbs./acre) if chloride is 1000 g/m^3
336.3 Kg/HA (300 lbs./acre) if chloride is 1001-1500 g/m^3
224.2 Kg/HA (200 lbs./acre) if chloride is 1501-2500 g/m^3

4) This office must be notified at least 24 hours prior to commencement of pumping in order that an officer of the Division may witness the operations.

5) A representative of the operator must be present at all times during pumping operations.

6) The volume of fluid pumped should be measured with a flow meter.

7) The pumped fluid must be dispersed in a manner that does not create pooling or erosion.

8) An analysis of the sludge in the bottom of the sump must be submitted to this office. The required tests are listed below.

9) At the conclusion of pump-off operations a written report detailing fluid volume pumped and showing the size and location of the irrigated area must be submitted to the District Office.

SLUDGE ANALYSIS REQUIREMENTS

Sodium	Lead
Calcium	Zinc
Chloride	Nitrogen (Total Kjeldahl)
Silver	Phosphorous (total)
Arsenic	Potassium
Cadmium	Sulphate
Copper	Total Organic Carbon
Iron	Total Inorganic Carbon
Mercury	Total Sulphur
Magnesium	pH
Manganese	BOD
Nickel	

C. Lease Cleanup Proposal

After a sump fluid analysis and fish bio-assay have been done, a lease cleanup proposal must be submitted to the District Office before any restoration begins. A standard form is available from the District Office (Figure 6-2) for the operator to complete as in Figure 6-3. The form illustrated in Figure 6-2 was developed at a time when deep trenching was the preferred method and has limited application for the various other cleanup methods. Because of this the operators may submit their own sketch of the cleanup proposal as long as it includes the following information:

1) a schematic diagram of the location and campsite areas (indicate north compass heading);
2) full name and legal description of the location;
3) well authorization number;
4) name of the laboratory that did the sump analysis and the analysis report number;
5) name and address of cleanup contractor;
6) name and address of person submitting the proposal;
7) status of the well (abandoned, wellhead, etc.);
8) date construction will start;
9) dimensions and volumes of all rig and campsite sumps;
10) total amount of fluid to be contained;
11) depth and height of any cut or fill area;
12) where the topsoil has been stockpiled, if it has not been spread (all initial cleanups done after rig release must have this information);
13) access roadway entrance onto the lease;
14) if trenching method is used, number the trenching sequence, length, width and depth of trenches along with the baffle height and distance.

The operator should make two copies of this proposal. One copy is to be submitted to the District Office for initial approval. The second copy is to be submitted immediately following completion

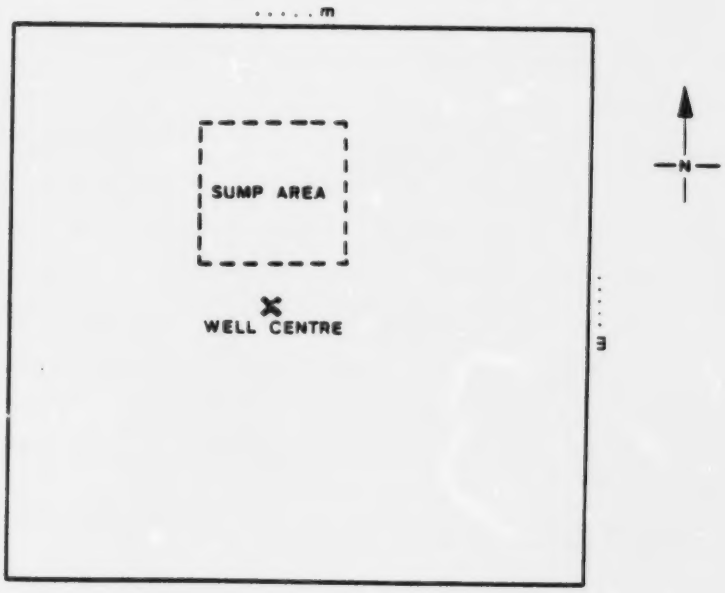
of the cleanup, with any alterations from the original proposal clearly marked on the diagram. Even if there are no alterations the second copy is to be submitted to the District Office.

SUMP CLEANUP PROPOSAL

Well Name ..... W.A. No. .....
Sump Analysis Laboratory ..... Report No. .....
Cleanup Contractor ..... Telephone No. .....
Address ..... Submitted By .....
Date Started ..... Date Completed ..... Total Fluid ..... m^3
Trenches:
from ..... to ..... length ..... m width ..... m depth ..... m
from ..... to ..... length ..... m width ..... m depth ..... m
from ..... to ..... length ..... m width ..... m depth ..... m
from ..... to ..... length ..... m width ..... m depth ..... m
from ..... to ..... length ..... m width ..... m depth ..... m
Trench baffles every ..... m height ..... m

Ministry of Energy, Mines & Pet. Res. Approval ..... Date .....
Remarks .....
.....

Wellhead ☐
Abandoned ☐



Indicate: Dirt cut, fill area, access road entrance, campsite area and sump. Rig sump dimensions, flare pit, topsoil stockpile area if applicable.

MAKE TWO COPIES. SUBMIT SECOND COPY FOR INITIAL APPROVAL. SUBMIT ORIGINAL COPY WITH ALTERATIONS, IF ANY, WHEN RESTORATION IS COMPLETED.

Figure 6-2. Cleanup Proposal Form

SUMP CLEANUP PROPOSAL

Well Name . . . NORTHERN OIL et al W. STODDART . #6-34-86-16 . . . . . W.A. No. . . 4802. . . . . .
Sump Analysis Laboratory . . C.S.S. LABS. LTD. . . . . Report No. . E.73-4806 . . . . . .
Cleanup Contractor . . . EARTH MOVING CONTRACTORS . . . . . Telephone No. . .785-4315 . . . .
Address . . . OIL CITY, B.C. . . . . Supervised By . W.A. OVERSEER . . . . . .
Date Started . . . 73-12-02 . . . . . Date Completed . . . . . Total Fluid . . . 2028. m^3
(12 750 bbl)

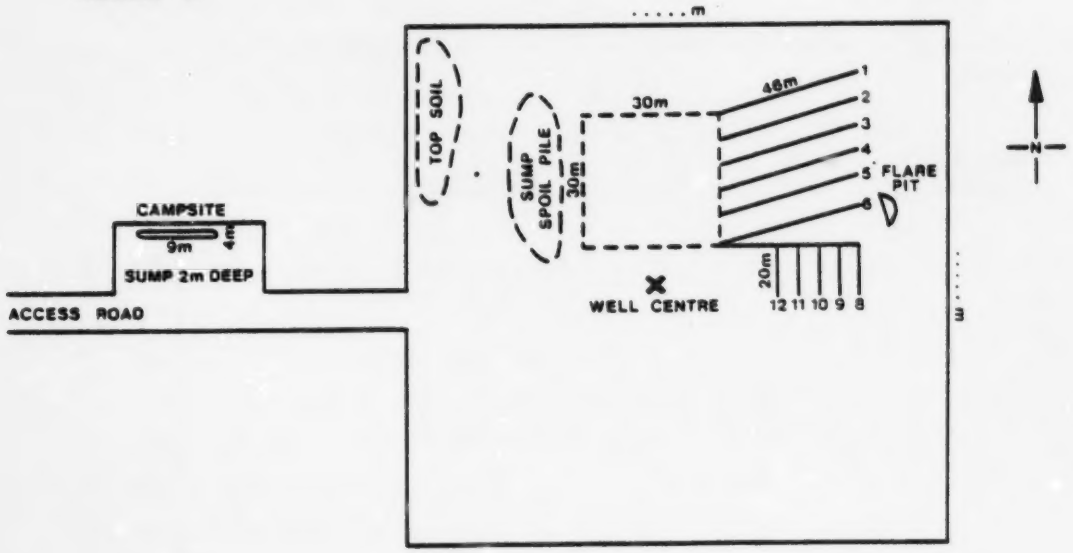
Trenches:

from	1	to	2	length	48	m	width	0.6	m	depth	3	m
from	3	to	12	length	20	m	width	0.6	m	depth	3	m
from		to		length		m	width		m	depth		m
from		to		length		m	width		m	depth		m
from		to		length		m	width		m	depth		m

Trench baffles every . . . 7 . . . m height . . . 0.5 . . . m

Ministry of Energy, Mines & Pet. Res. Approval . . . JOHN SMITH . . . . . Date . . . 73-12-01 . . . . . .
Remarks . . . . . ALL FLUIDS TO BE CONTAINED WITHIN LOCATION AREA . . . . . .
. . . . . NO TRENCHES IN ANY FILL AREA . . . . . .

Wellhead ⊠
Abandoned □



Inclusion: Dirt cut, fill area, access road entrance, campsite area and sump. Rig sump dimensions, flare pit, topsoil stockpile area if applicable.

MAKE TWO COPIES. SUBMIT SECOND COPY FOR INITIAL APPROVAL. SUBMIT ORIGINAL COPY WITH ALTERATIONS, IF ANY, WHEN RESTORATION IS COMPLETED.

Figure 6-3. Sample of completed Cleanup Proposal Form.

VII LEASE CLEANUP METHODS

Prior to outlining specific methods of sump fluid disposal and restoration it is helpful to understand some problem areas that are usually not considered prior to the actual cleanup.

It is very important to minimize the possibilities of diesel fuel and crankcase oil from entering the sump. If these hydrocarbons are present in any significant amount it then becomes virtually impossible to effectively chemically treat the sump. If the operator is planning to dispose of drilling fluids by pumping off, then a wash water pit (page 30) is a must.

During the actual sump cleanup it is important to thoroughly mix the bottom and side layers of sludge with the spill pile dirt while burying. The reason for this is twofold: to break up the sludge layer which is mostly bentonite, and to expose the sludge to the soils which contain microbes that will aid in the detoxification process. If the sludge is just buried in place, the end result will be an impermeable lense that will always be water-saturated. The sludge must be mixed with soil to help break up this water-tight barrier. The microbes are micro-organisms that occur naturally in the soil and particularly in the top layer of soils to a depth of 1.5 metres. When mixed in with the sludge and sump fluid the microbes will break down the chemical components and essentially help to detoxify them.

One last item must be mentioned before cleanup methods are discussed and that is the KCL and invert mud systems. None of the following cleanup methods apply to either of these fluid systems. Where possible the Ministry of Energy, Mines and Petroleum Resources

discourages the use of either mud system because of the problem in disposal. To date the only acceptable disposal methods are downhole disposal or disposing at a recognized waste treatment plant. At the time of this writing such a waste treatment plant does not exist in British Columbia.

A. Deep Trenching

Due to the problem of trench sagging and possible groundwater contamination associated with this method, it is expected that in future deep trenching will be allowed only where there are no other alternatives. At the time of this writing it is still an acceptable method of sump fluid disposal.

Deep trenching, as the name suggests, is simply allowing the sump fluid to be disposed of by burying it in a series of trenches that extend out from the main sump (Figure 7-1). The amount of fluid that can be trenched onto a lease site depends on the size of the lease. For a standard 1.6-hectare lease, a maximum of 1272 m^3 is allowed to be trenched away. Trench depths will vary depending on the area where the trenches can be located and the amount of fluid to be contained. The most favourable area to locate the trenches is between the sump and the flare pit (figure 7-1). Baffles are constructed (Figure 7-1) in the bottom of the trench and allow the fluids to be buried from one end without squeezing the fluid out the opposite end. A typical trenching sequence would be as follows:

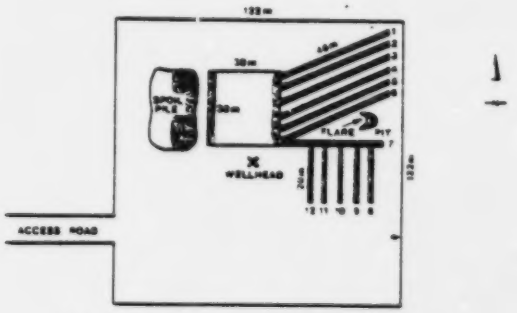
1) After the first trench has been excavated completely, the baffle adjacent to the sump can be opened to allow fluids to enter this trench only to a depth of 1.5 metres or not higher than the top of the bottom baffle.
2) Trench No. 2 excavation can begin approximately two metres from trench No. 1 with excavated soil being cast directly into trench No. 1.
3) After trench No. 2 has been excavated and trench No. 1 filled, it will become evident whether more or less fluid can be contained in the ensuing trenches, depending on the absorption capabilities of the soil.

4) Other equipment can begin filling in the main sump and squeezing fluids toward the trenching area.

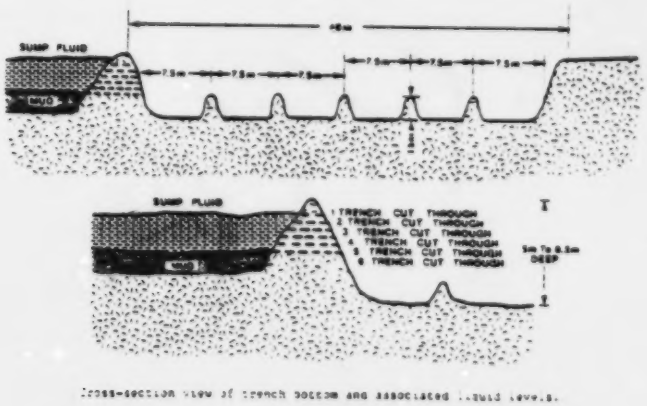
5) As the containment and squeezing progress, heavier, less viscous fluids and drilling mud will become evident. If there is sufficient space remaining in the trenching area, fluids can be contained in the same manner as outlined previously. However if the area is limited, a series of trench laterals can be excavated starting at the last trench extremity and repeating the same procedure as outlined earlier.

6) When all the sump fluids have been contained, other equipment can proceed with compacting the trenched area and landscaping the lease.

7) Compaction of soil in the trenches will be minimal. Further filling and landscaping will be required when the soil has finally settled.



Plan view of lease area showing location of trenches.



Cross-section view of trench bottom and associated liquid levels.

Figure 7-1. Fluid disposal by trenching.

SHALLOW TRENCHING METHOD

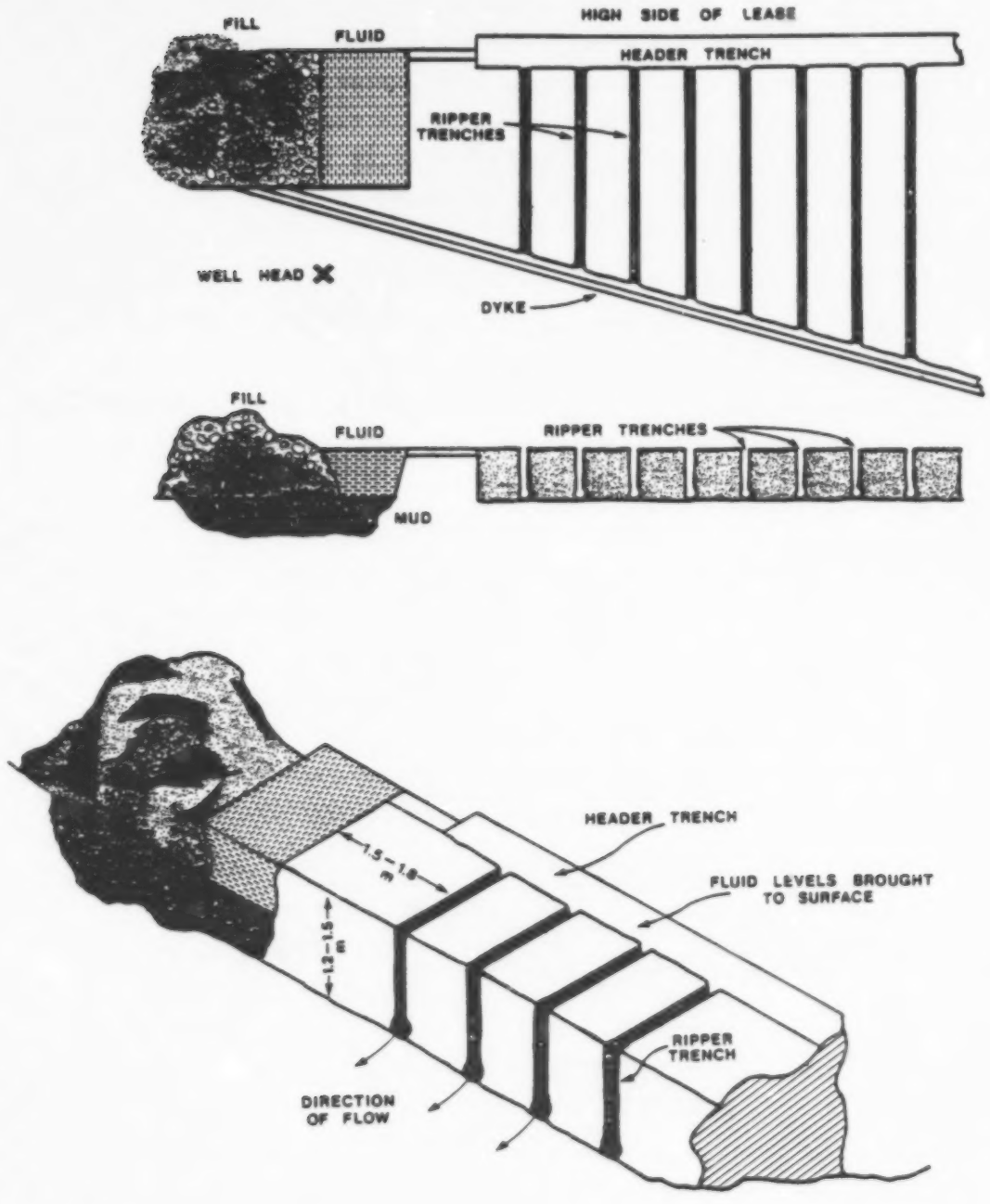


Figure 7-2. Fluid disposal by shallow trenching.

B. Shallow Trenching

The shallow trenching method is relatively new to British Columbia and because of this has not been used extensively. Fluid disposal is accomplished by pulling a bullet shaped swage through the soil at a depth of 1.2 metres (Figure 7-2). The swage is attached to the long-shank ripper on a crawler tractor. The ripper and attached swage are lowered into the sump, then pulled forward through the soil as illustrated in Figure 7-2. The void space created by the swage is filled with sump fluids and the soil layer above the swage is broken up by the ripper, allowing the fluids to be absorbed into this layer. The trenches may be spaced as close as .5 metre apart depending on soil type and ultimately the soil saturation. As the fluid level in the sump drops, equipment will be needed to squeeze the sump to ensure that all fluid will be trenched. The fluid volume restrictions to be trenched and the location of the trenches are the same as deep trenching. There are some advantages to this method:

1) The sump fluid is disposed of within the top 1.5 metres which will encourage a faster aerobic breakdown.
2) The degree of settling is greatly reduced when compared to deep trenching.
3) The overall costs are less than deep trenching.

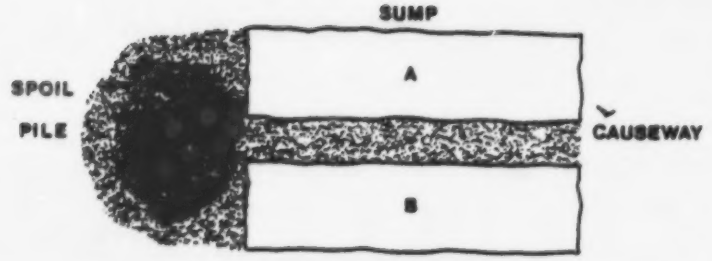
The limitations of this method are:

1) Soil must be relatively free of rock.
2) Soil must not be frozen.

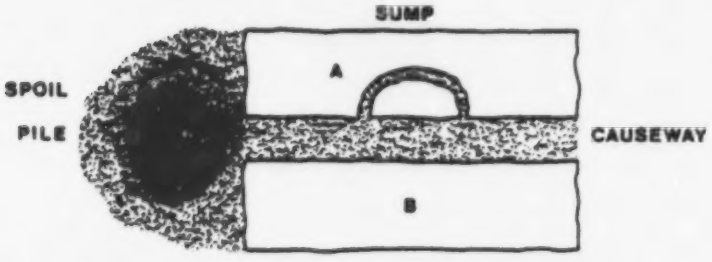
As in deep trenching a maximum of $1272m^3$ of fluid can be disposed of on a 1.6-hectare lease.

C. Sump Fluid Disposal to a Subsurface Formation

Sump fluid disposal to a subsurface formation where possible is encouraged by the Ministry of Energy, Mines and Petroleum Resources. Downhole fluid disposal must be to a formation deeper

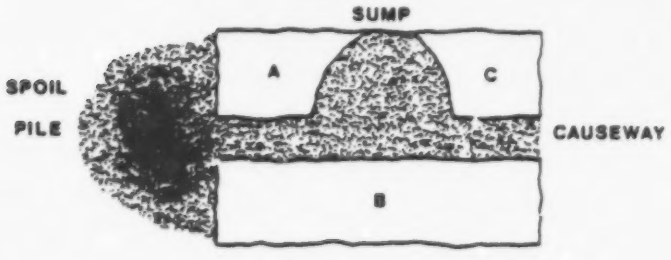


a) Push soil out into the sump forming causeway. Divides sump into two parts, A & B.

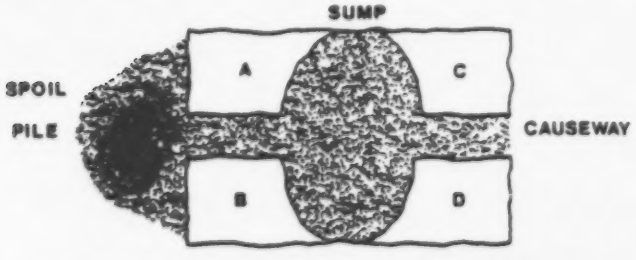


b) Construct an arc, then fill and mix soil inside this arc.

Figure 7-3. Fluid disposal by trap and mix.



c) Construct another arc and fill in until sump is divided into three different areas, A, B & C.



d) Use the same technique on opposite side of the causeway, the sump is divided into four parts, A, B, C & D.

Figure 7-4. Disposal by trap and mix.

than 610 metres and to a formation acceptable to the Petroleum Resources Division. This is easily accomplished with minimal risk and cost, if a well is being abandoned. This method can also be accomplished if a well has production or intermediate casing installed and can be undertaken while drilling operations are underway. In these cases additional criteria such as cement tops, lost circulation formations, casing collapse or burst pressures must all be considered.

An operator who may wish to use downhole disposal must obtain approval from the District Office in Charlie Lake and upon completion submit a complete report detailing the entire operation (volumes and pressures etc.)

D. Sump Fluid Disposal by Pump-Off

Discussion on page 52.

E. Trap and Mix

This is also a relatively new cleanup method that has been used in British Columbia and has shown promising results. This method is accomplished by using a crawler tractor and a large back-hoe to trap the fluid in segments and mix the spoil pile into the sump fluid.

A typical trap and mix cleanup would be as follows:

1) Push soil from the spoil pile into the sump to form a causeway (Figure 7-3a). The fluid is now trapped in two areas, A and B.
2) The back-hoe, working from the causeway, can cast fill and mix sludge to form an arc on one side (Figure 7-3b). The back-hoe then proceeds to mix fill material with sludge from the sump bottom to fill the inside area of the arc.

3) Continue to work in the same direction constructing arcs to trap the fluid and then mixing fill material, fluids and sludge together. The end result is that the sump is divided into three remaining areas (Figure 7-4c).
4) The same method is applied to the opposite side of sump, resulting in the sump now being divided into four remaining areas (Figure 7-4d).
5) Each remaining area is then handled the same way until the sump is completely filled. Final touch-up work is completed with the crawler tractor. The important aspect of this method is to first trap small areas of fluid and then to thoroughly mix the sludge and fluids that are trapped with the fill material.

By using this method all of the spoil pile is completely used and in some cases it may be necessary to obtain additional fill material to complete the cleanup. Because of this it is important that none of the spoil pile from the sump be used as fill material during lease construction.

Advantages of using this system are as follows:

1) Subsoil, sump fluids and sludge are all intermixed, encouraging microbial detoxification to take place.
2) By mixing up the sludge layer (mostly bentonite) this helps prevent the "impermeable lense" effect.
3) It allows good compaction of all material and uses less area for disposal resulting in less sump settlement.
4) It can be used during winter.

The limitations to this method are:

1) The sump must have at least 40 per cent freeboard; otherwise the sump must first be enlarged to obtain this prior to the start of cleanup.
2) The operator must be sure to reach the bottom of the sump and mix thoroughly.

F. Summary

Whether using only one disposal method or a combination of the above methods, all have been used successfully in British Columbia. It is highly recommended that, after completion of all initial cleanups, the sump be mounded up above the original level. This will ensure that after the sump has settled there is material readily available for the secondary touch-up work. This is extremely important during the winter months when the fill used is frozen and often contains ice and snow. The biggest single factor that causes sumps to continually settle over a long period of time is a poorly done initial cleanup. Time spent on this stage will save the operator the expense and problems of third and even fourth time touch-up restoration work.

VIII RESTORATION REQUIREMENTS

On all locations the drilling sump and campsite excavations must be restored to their original contour. This usually requires an initial cleanup following rig release and secondary touch-up work to fill in the settled areas a year or two later. Once the sump areas have been taken care of, the next consideration is preparing the surface of the lease. The requirements here depend upon the status of the well, whether it is abandoned, producing, or suspended.

A. Producing Wells

A lease which is productive is said to be satisfactorily restored when all excavations are filled and the lease is contoured to accomodate the production equipment. The cut and fill slopes of a production lease should be contoured to a slope of not greater than 2:1 and seeded to prevent erosion (seed the slopes only). The lease area being used should be kept blackened to lower the fire hazard and reduce the possibility of weeds growing on the lease.

The topsoil that has been stripped off during construction should be spread over an area separate from the useable lease area. A record of this storage is to be included with the final copy of the cleanup proposal form. This will ensure that a permanent record is available for use when the well is eventually abandoned and the lease area restored. Because a well may be productive for periods up to 30 years, it is of the utmost importance that this record be accurate.

B. Suspended or Shut-in Wells

Wells that are not producing because of lack of a pipeline or poor economics fall into this category. Generally these wells are not checked on a regular basis. Because of this, special requirements are needed for these wells. All wellheads should be chained and locked to prevent tampering. All locations should have an accurate well sign in place. For remote locations it is suggested that a metal tag be used and attached to the wellhead; this will discourage hunters from using the sign as a target. Again a record of the topsoil storage should be filed at the Charlie Lake District Office on the cleanup proposal. It is recommended that the lease area not be seeded to any seed mix unless erosion will become a problem, or in rare cases, to prevent noxious weeds from growing. The Ministry of Energy, Mines and Petroleum Resources highly recommends that the operator check all their shut-in wells yearly, to maintain vegetation growth at a minimum and ensure that all wellheads, valves, etc. are not leaking and are operational.

C. Abandoned and Cancelled Locations

Any wellsite location that is to be abandoned must meet the following requirements:

1) All excavations are to be filled back to the original contour.
2) All cut and fill slopes are to be returned to the original contour (if practical).
3) All equipment and/or facilities are to be removed from the lease.
4) Culverts are to be pulled from the access road.
5) Topsoil is to be spread across lease, but only after all excavations have quit settling and are level.
6) Erosion control measures are to be constructed on the lease and access road as required.
7) Lease and access road should be seeded (on private land consult landowner).

8) Abandoned locations on Crown land are to have a well identification sign welded to the casing stub.

9) An Application for a Certificate of Restoration is to be submitted, after all final restorations, to the District Office. Cancelled locations where no construction was done are exempt from this requirement.

1. **Seeding Requirements** - Seeding is required on abandoned and cancelled lease and road sites on Crown land. The operator is to use Canada #1 Certified Forestry Seed Mix. Do not seed any area on private land unless the surface rights landowner consents to the type of seed and seeding requirements.

The main function of seeding abandoned sites is to help prevent erosion. The seed mix will also help to prevent weeds from establishing on site. A third spin-off benefit is that in some areas the vegetation growth will supply food for the wildlife population.

2. **Application for a Certificate of Restoration** - Before a Restoration Certificate can be applied for, the lease must be an abandoned location or a cancelled location where construction was done, and the location must be fully restored. Experience has proven that a location cannot be fully restored at the time of initial cleanup. The drill sump will always settle to some extent. For this reason it is recommended that the topsoil be left piled after the initial cleanup. One year later, after the sumps have settled, the contractor can move on site and refill all the sumps, spread the topsoil and complete the rest of the restoration. A further year must then pass before the District Office will conduct a final inspection. It has become policy that a minimum of

two years must pass following the initial cleanup before a Certificate of Restoration will be considered for approval. This, of course, is assuming the secondary restoration work (spreading of topsoil, seeding, etc.) has been completed on schedule, one year after the initial work.

The procedure for submitting an Application for a Certificate of Restoration is as follows:

1) The location must be abandoned or a cancelled location that had actual construction work done to it. If a location is surveyed only and then cancelled, an Application is not required.
2) An Application (Form No. 36) is to be submitted immediately following the final secondary restoration work.
3) A sketch map of the lease and access road is to accompany the Application with all areas of restoration outlined in coloured pen and any area not restored (borrow pits, access road, etc.) outlined in a different colour. Legend to be provided.
4) On any location on private land, a letter of release signed by the landowner indicating satisfaction with the restoration is to be submitted with the application. If the landowner wishes to have any access road, borrow pit, facility, etc. left in place then the letter shall detail the requirements.
5) The operator is to provide transportation to all remote sites.

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APPENDICES

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APPENDIX A

MAPS AND AERIAL PHOTOGRAPHS

Maps and aerial photographs are essential in the planning and operational stages of any exploration project. Most areas of the province are covered by a variety of maps and aerial photographs at different scales. The following describes different map types, uses and where they can be obtained.

MAPS

SEISMIC ROAD AND TRAIL MAPS

Maps showing all roads, trails, bulldozed and hand-cut seismic lines on a 1:50 000 National Topographic Series.

These maps are complete with all new information reported to date and this updating is continuous. The location of designated oil and gas fields is shown. Not all areas of British Columbia are covered by this series.

For a complete catalogue and ordering information contact:

Ministry of Energy, Mines and Petroleum Resources
Parliament Buildings
Victoria, B.C.
V8V 1X4
Phone (604) 387-3188

TOPOGRAPHIC MAPS

Topographic maps are available in scales of 1:50 000, 1:100 000, 1:125 000 and 1:500 000. They generally show: water features, contour lines, cultural features, such as place names, roads, railways and boundaries, and land status to the date of publication. They are useful for interpretation of drainage and terrain characteristics, slopes and topographic relief. The scale map of 1:50 000 is most suitable and preferred.

PLANIMETRIC MAPS

These maps are drawn from vertical air photographs tied to existing ground control. They are thus, to a certain extent, uncontrolled and geographic detail may be unreliable. However, relative positions have been maintained as accurately as possible and these maps have been found to be quite suitable for most general purposes.

Planimetric maps are available in most areas in scales of 1:15 840, 1:20 000, 1:31 680 and 1:63 680 generally show all planimetric detail such as roads, water features, and log boundaries. No contours are shown. The positions of the centres of air photographs used in compilation are marked with flight and photograph numbers. This allows detail to be easily transferred from photographs to maps and vice versa.

MINISTERIAL REFERENCE MAPS

Ministerial reference maps show all types of land alienations such as surveyed lots and sections, applications to purchase or lease, forestry leases and licenses, mining leases and licences, and all reserves. Copies available to the public show all information to date of publication and is being constantly updated. They are generally available in scales of 1:31 680 and 1:63 360.

SOILS AND LANDFORMS MAPS

These are available for many parts of the Province in published or provisional form at a scale of 1:50 000. When used in conjunction with topographic maps they are useful for interpreting soil stability and construction characteristics, erosion hazard, and availability of construction material.

VEGETATION MAPS

These are available at a scale of 1:50 000 as forest cover maps over most of the Province and as vegetation maps in more

restricted areas. They show forest species composition as well as forest productivity.

LAND CAPABILITY MAPS

Capability maps are available for agriculture, forestry, recreation, ungulates, waterfowl, aquatics, and climate. Land capability analysis maps are also available for some areas. These maps are at scales of 1:50 000 and 1:250 000 and are useful for preplanning of field programs and identification of sensitive areas.

For a complete catalogue and ordering information contact:

Maps - B.C.
Surveys and Resource Mapping Branch
Ministry of Environment
Parliament Buildings
Victoria, B.C.
V8V 1X5
Phone (604) 387-1441

AERIAL PHOTOGRAPHY AND MOSAICS

The Federal Government and the Provincial Government are the main sources of air photographs covering the Province. Negatives of the photographs taken by the Federal Government are held in Ottawa; those taken by the Provincial Government are held in Victoria.

Photographs are exposed from various altitudes with various cameras and provide overlapping or 'stereo' cover on the ground. The scale of photography varies, depending upon the height of the aircraft above ground, the focal length of the camera used, and the size of the photographic print. Over mountainous terrain the scale varies considerably within each photo.

For ease of reference, photographs are plotted as accurately as possible on index maps, copies of which are available.

The Surveys and Resources Mapping Branch maintains a library of air photographs taken by the Provincial Government. These library prints are available for reference viewing at the MAPS Office, located at 553 Superior Street, Victoria.

For a complete catalogue and information regarding indexes, ordering, date of flying, scale, etc., contact:

Maps - B.C.
Surveys and Resources Mapping Branch
Ministry of Environment
Parliament Buildings
Victoria, B.C.
V8V 1X5
Phone (604) 387-1441

In cooperation with the National Air Photo Library in Ottawa, microfilm of Federal Air Photography, with the relevant air photo indexes and catalogue for British Columbia, Yukon and Northwest Territories is available for viewing at the MAPS Office, located at 553 Superior Street, Victoria.

Further information regarding Federal Government photographs, their catalogue indexes, dates of flying, prices, etc., may be obtained by writing directly to:

National Air Photo Library
Department of Energy, Mines and Resources
615 Booth Street
Ottawa, Ontario
K1A 0E9
Phone (613) 998-9900

APPENDIX B

LICENCE TO CUT TIMBER

LICENCE TO CUT TIMBER

File (Wellsite) _____

PRINCE GEORGE REGION

Pursuant to Section 47 of the Forest Act

THIS INDENTURE MADE THIS _____ DAY OF _____ 19___

BETWEEN

THE MINISTRY OF FORESTS OF THE PROVINCE OF BRITISH COLUMBIA, herein represented and acting by the District Manager of the above named Region (hereinafter called the "Licensor").

AND

(Hereinafter called the "Licensee"), OF THE SECOND PART.

WHEREAS the Licensee is the occupier of Crown Lands and the Licensor has agreed to grant a licence to the Licensee pursuant to the said Section 47 of the Forest Act to cut and remove or destroy forest growth subject to the following terms and conditions:

1. This licence shall expire _____.
2. The Licensee is authorized to cut and remove or destroy forest growth from those wellsite, campsites or main access roads which are required in conjunction with wellsites under Well Authorization # _____ and that are on Vacant Crown Land.
3. Provided that, on expiry of the term of the licence, all rights of the Licensee shall absolutely terminate and any and all timber cut from and lying on the licence area shall become the absolute property of the Licensor.
4. The Licensee agrees to mark all timber cut and removed from the said lands with the following timber mark: LGS_____.
5. Unless the Licensor determines otherwise, timber cut under the Licence will be scaled according to the Forest Act.
6. Prior to the commencement of operations, the Licensee or his contractor shall contact the office of the District Manager at Fort St. John, B.C. to confirm the date of commencement of operations.
7. The Licensee covenants with the Licensor to pay all (taxes, forest protection taxes, if any), stumpage and royalty, and any other charges immediately upon receipt of account thereafter.
8. The Licensee shall maintain in good standing the authority by which he is in occupation of the licence area. Should any contravention be made of that authority, the licence is suspended until the contravention is remedied.
9. The Licensor may cancel this licence in the event the Licensee fails to comply with the terms and conditions of the licence or the authority to which the granting of the licence is based, or no longer has any interest, or is no longer occupier of the said lands.
10. The Forest Officer in charge, by giving notice to that effect in writing to the Licensee, or to the person in charge of operations upon the area, may suspend any operations conducted upon this area should violation of any of the terms, covenants,

provisos, or conditions of the licence have occurred, and such violation shall render this licence liable to cancellation by the Minister.

11. Provided further that the interest, rights, and privileges of the Licensee in the said hereditaments, tenants, and premises shall be construed as subject always to all the provisions of the Forest Act and amendments thereof and regulations thereunder.

12. The Licensor reserves the right to suspend or cancel this licence if the Licensee is, or becomes, bankrupt or insolvent.

13. The Licensee agrees that any person or persons who conducts or is conducting operations on the Licence area to the knowledge of, or with the consent of the Licensee is and are the agents of servants of the Licensee.

14. (a) Roads and seismic lines shall be constructed in such a manner that the grubbed width shall be a maximum of 7 metres. Any trees cut beyond this width without prior approval, and any trees cut on roads or lines that have not been approved will be considered as cut in trespass and billed at triple the timber damage charges.

(b) An assessment shall be made at an average rate of $90.00 per hectare based on the final plan submitted to the Chief Commissioner, Ministry of Energy Mines and Petroleum Resources, for any forest growth cut or destroyed under the terms of this licence.

(c) The Licensee is responsible for determining the status of those lands upon which geophysical or petroleum exploration operations are proposed and this licence pertains only to timber on Vacant Crown Lands.

(d) The Licensor will not be responsible for the establishment of any boundaries or for any trespass incurred by the Licensee. The Licensee covenants to indemnify and save harmless the Licensor from and against all claims for loss or damage arising out of any act or omission done

or caused by the Licensee, his servants, or workmen in carrying out the terms of the licence.

15. Slash Disposal Requirements

The Licensee agrees to dispose of all slash and debris in accordance with direction issued by the Forest Officer to comply with the Provisions of Part X of the Forest Act; and more specifically as follows:

A. Seismic Lines, Temporary Access Roads and Campsites

(i) Where a seismic line, temporary access road crosses a road campsite, or navigable waterway, all slash shall be completely disposed of within 400 metres of the centerline of the right-of-way being crossed, unless otherwise directed by the Forest Officer. For the reason of insect control, 100% disposal may be required in areas of known infestations at the discretion of the Forest Officer. Disposal shall be by piling and burning or burying, unless otherwise directed by the Forest Officer. Where slash is buried, it must be placed in a pit or trench below ground level and covered with one metre of mineral soil.

(ii) On all other sections of a seismic line or temporary access road forest growth shall be disposed of as follows:

a) Spray cutting in mature and immature stands where the stems per hectare do not exceed 500 per hectare. To complete this treatment, all trees felled shall have their branches lopped and scattered and the boles of trees shall be severed from the stump at the root collar and bucked so that each section shall lie close to the ground.

(b) In stands of other than (a) above all trees and slash shall be windrowed to one side of the line;

windrows shall be piled adjacent to the standing timber and shall be broken every 400 metres for a distance of not less than 3 metres. The slash piles must be compacted by bucking and limbing. In stands of timber 15 centimenters diameter at breast height and under, compacting may be done by means of walking down windrows with a tractor.

(c) Where approved by the Forest Officer in writing "walking down" of forest growth will be accepted in lieu of windrowing.

(d) In stands of open muskeg, willow, and aspen under 10 centimetres in diameter, hazard abatement may be achieved by "rolling" the windrow back onto the seismic line as directed by the Forest Officer.

B. Main Roads to Wellsites

(i) The Licensee agrees that this section, being part B, only applies where the wellsite has been authorized by the Ministry of Energy Mines and Petroleum Resources.

a) Right-of-way width shall not exceed 20 metres unless authorized by the Forest Officer. All trees must be felled onto the right-of-way. Those trees not utilized shall be piled or windrowed at least five metres from the standing timber. The piles and windrows must be burned at the first safe opportunity subject to obtaining a burning permit from the local Forest Officer pursuant to Section 113 of the Forest Act.

b) Where, after due notice, any Licensee fails to carry out any of the aforementioned requirements the Minister may, be his officer, enter upon the land on which the debris, dead trees, stumps, inflammable material, refuse timber, slash, chop-

pings, or bush in question exist and carry out the requirements of the section and recover the expenses incurred as a debt due the Crown pursuant to Section 119 of the Forest Act.

C. General Slash Requirements

(i) Slash disposal must be completed immediately following construction of seismic line, temporary access roads or mains roads unless otherwise authorized in writing by the Forest Officer.

(ii) No slash or debris shall be deposited in any water course. Any slash or debris unavoidably deposited in a water course shall be removed as soon as possible.

(iii) Failure to comply with slash disposal requirements may result in an assessment at the rate of $185.00 per hectare. (Applies to areas East of the Rockies only).

(iv) It is understood that from time to time it may be necessary to use an alternative treatment on treated areas to obtain the objectives. Any such treatment shall not be carried out without prior approval of the Forest Officer.

16. Erosion Control

(a) All seismic trails and access roads must be constructed in such a manner as to ensure that not more than one crossing is constructed at the intersection of the seismic trail or road and any stream.

(b) All precautionary measures such as cross trenching to prevent soil erosion and sedimentation to streams must be taken immediately following the completion of the seismic or drilling program.

(c) All seismic or access road construction within Provincial Grazing Reserves must be seeded as specified by the Forest Officer. Provided, however, that the Licensore may release the Licensee in whole or in part from this covenant.

(d) On all those portions of the seismic or access road construction where vegetative regeneration is deemed necessary, the Licensee may be required to seed to grass with specifications as to the rate, time and type of seed as authorized by the Forest Officer.

(e) In the event the Licensee fails to carry out the above measures, the District Manager may assess the Licensee the estimated costs to carry out such measures and the Licensee shall pay the account forthwith.

17. Other Conditions

(a) Upon completion of operations the Licensee along with the final notice, shall submit a properly drafted map showing all distrubances to the District Manager at a scale 1:50,000.

(b) It is understood that in addition to shasl disposal requirements, all other sections of Part 10 of the Forest Act shall apply,

DATED AT _____ THIS _____ DAY OF _____19___.

_____ SIGNATURE

_____ SIGNATURE OF WITNESS

_____ CORPORATE SEAL

_____ ADDRESS OF WITNESS

_____ DISTRICT MANGER MINISTRY OF FORESTS

_____ SIGANTURE OF WITNESS

_____ ADDRESS OF WITNESS

APPENDIX C

PERTINENT ACTS AND REGULATIONS OF THE FISHERIES ACT (CANADA)

APPENDIX C – PERTINENT ACTS AND REGULATIONS OF THE FEDERAL FISHERIES ACT

Fisheries Act

Section 31. *Harmful, alteration, etc. of fish habitat*

(1) No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat.

Alteration, etc. authorized

(2) No person contravenes subsection (1) by causing the alteration, disruption or destruction of fish habitat by any means or under any conditions authorized by the Minister or under regulations made by the Governor in Council under this Act.

Punishment

(3) Every person who contravenes subsection (1) is guilty of an offence and liable

(a) on summary conviction, to a fine not exceeding five thousand dollars for a first offence, and not exceeding ten thousand dollars for each subsequent offence; or

(b) on conviction on indictment, to imprisonment for a term not exceeding two years.

Application of section 33

(4) Subsections 33 (6) to (9) apply in respect of an offence under this section as if it were an offence under section 33.

"Fish habitat" defined

(5) For the purposes of this section and sections 33, 33.1 and 33.2, "fish habitat" means spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.

Section 33. *Throwing overboard of certain substances prohibited*

(1) No one shall throw overboard ballast, coal ashes, stones, or prejudicial or deleterious substances in any river, harbour or roadstead, or in any water where fishing is carried on, or leave or deposit or cause to be thrown, left or deposited, upon the shore, beach or bank of any water or upon the beach between high and low water mark, remains or offal of fish, or of marine animals, or leave decayed or decaying fish in any net or other fishing apparatus; such remains of offal may be buried ashore, above high water mark.

Deposit of deleterious substance prohibited

(2) Subject to subsection (4), no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where such deleterious substance or any other deleterious substance that results from the deposit of such deleterious substance may enter any such water.

Slash, stumps, etc., prohibited

(3) No person engaging in logging, lumbering, land clearing or other operations, shall put or knowingly permit to be put, any slash, stumps, or other debris into any water frequented by fish or that flows into such water, or on the ice over either such water, or at a place from which it is likely to be carried into either such water.

Deposits authorized by regulation

(4) No person contravenes subsection (2) by depositing or permitting the deposit in any water or place

(a) of waste or pollutant of a type, in a quantity and under conditions authorized by regulations applicable to that water or place made by the Governor in Council under any Act other than this Act; or

(b) of a deleterious substance of a class, in a quantity or concentration and under conditions authorized by or pursuant to regulations applicable to that water

or place or to any work or undertaking or class thereof, made by the Governor in Council under subsection (13).

Offence and punishment

(5) Any person who contravenes any provision of

(a) subsection (1) or (3) is guilty of an offence and liable on summary conviction to a fine not exceeding five thousand dollars for a first offence, and not exceeding ten thousand dollars for each subsequent offence; or

(b) subsection (2) is guilty of an offence and liable on summary conviction to a fine not exceeding fifty thousand dollars for a first offence, and not exceeding one hundred thousand dollars for each subsequent offence.

(6) Where an offence under subsection (5) is committed on more than one day or is continued for more than one day, it shall be deemed to be a separate offence for each day on which the offence is committed or continued.

Order to refrain or take action

(7) Where a person is convicted of an offence under this section, the court may, in addition to any punishment it may impose, order that person to refrain from committing any further such offence or to cease to carry on any activity specified in the order the carrying on of which, in the opinion of the court, will or is likely to result in the committing of any further such offence or to take such action specified in the order as, in the opinion of the court, will or is likely to prevent the commission of any further such offence.

Proof of offence

(8) In a prosecution for an offence under this section or section 33.4, it is sufficient proof of the offence to establish that it was committed by an employee or agent of the accused whether or not the employee or agent is identified or has been prosecuted for the offence, unless the accused establishes that the offence was committed without his knowledge or consent and that he exercised all due diligence to prevent its commission.

Action to enjoin not prejudiced by prosecution

(9) Notwithstanding that a prosecution has been instituted in respect of an offence under this section, the Attorney-General of Canada may commence and maintain proceedings to enjoin any violation of any provision of this section.

Civil liability

(10) Where there occurs a deposit of a deleterious substance in water frequented by fish that is not authorized under this section or a serious and imminent danger thereof by reason of any condition, the persons who at any material time

(a) own the deleterious substance or have the charge, management or control thereof, or

(b) are persons other than those described in paragraph (a) who cause or contribute to the causation of the deposit or danger thereof,

are, subject to subsection (10.2) in the case of the persons referred to in paragraph (a) and to the extent determined according to their respective degrees of fault or negligence in the case of the persons referred to in paragraph (b), jointly and severally liable for all costs and expenses incurred by Her Majesty in the right of Canada or a province, to the extent that such costs and expenses can be established to have been reasonably incurred in the circumstances, of and incidental to the taking of any measures to prevent any such deposit or condition or to counteract, mitigate or remedy any adverse effects that result or may reasonably be expected to result therefrom, and all such costs and expenses are recoverable by Her Majesty in right of Canada or a province with costs in proceedings brought or taken such right in any court of competent jurisdiction.

Idem

(10.1) Where, as a result of a deposit that is not authorized under this section, a deleterious substance enters water frequented by fish, the persons who at any material time

(a) own the deleterious substance or have the charge, management or control thereof, or

(b) are persons other than those described in paragraph (a) who cause or contribute to the causation of the deposit

are, subject to subsection (10.2) in the case of the persons referred to in paragraph (a) and to the extent determined according to their respective degrees of fault or negligence in the case of the persons referred to in paragraph (b), jointly and severally liable for all loss of income incurred by any licensed commercial fisherman, to the extent that such loss can be established to have been incurred as a result of the deposit or of a prohibition to fish resulting therefrom, and all such loss is recoverable with costs in proceedings brought or taken therefore in any court of competent jurisdiction.

Defences to liability

(10.2) The liability of any person referred to in paragraph (10) (a) or (10.1) (a) is absolute and does not depend on proof of fault or negligence but no such person is liable for any costs and expenses pursuant to subsection (10) or loss of income pursuant to subsection (10.1) if he establishes that the occurrence giving rise to the liability was wholly caused by

(a) an act of war, hostilities, civil war, insurrection or a natural phenomenon of an exceptional, inevitable and irresistible character, or

(b) an act or omission with intent to cause damage by a person other than a person for whose wrongful act or omission he is by law responsible,

and nothing in this subsection, subsection (10) or subsection (10.1) limits or restricts any right of recourse that any person who is liable pursuant to subsection (10) or (10.1) may have against any other person.

Other civil remedies not affected

(10.3) No civil remedy for any act or omission is suspended or affected by reason only that the act or omission is authorized under this Act, is an offence under this Act or gives rise to civil liability under this section.

Limitation

(10.4) No proceedings may be commenced under subsection (10) or (10.1) at any time later than two years after the occurrence to which the proceedings relate could reasonably be expected to have become known to Her Majesty in right of Canada or a province or to any licensed commercial fisherman, as the case may be.

Exception

(10.5) Notwithstanding anything in this section, subsections (10) and (10.1) do not apply in respect of any deposit of a deleterious substance that, within the meaning of Part XX of the *Canada Shipping Act*, constitutes a discharge of a pollutant caused by or otherwise attributable to a ship.

Definitions

(11) For the purposes of this section and sections 33.1 and 33.2,

"deleterious substance"

"deleterious substance" means

(a) any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water, or

(b) any water that contains a substance in such quantity or concentration, or that has been so treated, processed or changed, by heat or other means, from a

natural state that it would, if added to any other water, degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water,

and without limiting the generality of the foregoing includes

(c) any substance or class of substances prescribed pursuant to paragraph (12) (a),

(d) any water that contains any substance or class of substances in a quantity or concentration that is equal to or in excess of a quantity or concentration prescribed in respect of that substance or class of substances pursuant to paragraph (12) (b), and

(e) any water that has been subjected to a treatment, process or change prescribed pursuant to paragraph (12) (c);

"deposit" "deposit" means any discharging, spraying, releasing, spilling, leading, seeping, pouring, emitting, emptying, throwing, dumping or placing;

"water frequented by fish" "water frequented by fish" means Canadian fisheries waters.

Regulations (12) The Governor in Council may make regulations prescribing

(a) substances and classes of substances,

(b) quantities or concentration of substances and classes of substances in water, and

(c) treatments, processes and changes of water

for the purpose of paragraphs (c) to (e) of the definition "deleterious substance" in subsection (11).

Regulations (13) The Governor in Council may make regulations for the purpose of paragraph (4) (b) prescribing

(a) the deleterious substances or classes thereof authorized to be deposited notwithstanding subsection (2);

(b) the waters or places or classes thereof where any deleterious substances or classes thereof referred to in paragraph (a) are authorized to be deposited;

(c) the works or undertakings or classes thereof in the course or conduct of which any deleterious substances or classes thereof referred to in paragraph (a) are authorized to be deposited;

(d) the quantities or concentrations of any deleterious substances or classes thereof referred to in paragraph (a) that are authorized to be deposited;

(e) the conditions or circumstances under which and the requirements subject to which any deleterious substances or classes thereof referred to in paragraph (a) or any quantities or concentrations of such deleterious substances or classes thereof are authorized to be deposited in any waters or places or classes thereof referred to in paragraph (b) or in the course or conduct of any works or undertakings or classes thereof referred to in paragraph (c); and

(f) the persons who may authorize the deposit of any deleterious substances or classes thereof in the absence of any other authority, and the conditions or circumstances under which and requirements subject to which such persons may grant such authorization.

Directions by the Minister

(14) A person authorized to deposit a deleterious substance by or under regulations made pursuant to subsection (13) shall, when directed in writing by the Minister, notwithstanding any regulations made pursuant to paragraph (13) (e) or any conditions set out in an authorization made pursuant to paragraph (13) (f),

(a) conduct such sampling, analyses, tests, measurements or monitoring,

(b) install or operate such equipment or comply with such procedures, and

(c) report such information

as may be required by the Minister in order to determine whether the person is depositing the deleterious substance in the manner authorized.

Minister may require plans and specifications

33.1 (1) Every person who carries on or proposes to carry on any work or undertaking that results or is likely to result in

(a) the deposit of a deleterious substance in water frequented by fish or in any place under any conditions where that deleterious substance or any other deleterious substance that results from the deposit of that deleterious substance may enter any such water, or

(b) the alteration, disruption or destruction of fish habitat,

shall, on the request of the Minister or without request in the manner and circumstances prescribed by regulations made under paragraph (3) (a), provide the Minister with such plans, specifications, studies, procedures, schedules, analyses, samples or other information relating to the work or undertaking and with such analyses, samples, evaluations, studies or other information relating to the water, place or fish habitat that is or is likely to be affected by the work or undertaking as will enable the Minister to determine

(c) whether there is or is likely to be a deposit of a deleterious substance by reason of such work or undertaking that constitutes or would constitute an offence under section 33 and what measures, if any, would prevent such a deposit or mitigate the effects thereof; or

(d) whether the work or undertaking results or is likely to result in any alteration, disruption or destruction of fish habitat that constitutes or would constitute an offence under section 31 and what measures, if any, would prevent such a result or mitigate the effects thereof.

Powers of Minister

(2) If, after reviewing any material or information provided under subsection (1) and affording the persons who provided it a reasonable opportunity to make representations, the Minister or a person designated by the Minister is of the opinion that an offence under section 31 or 33 is being or is likely to be committed, the Minister or a person designated by the Minister may, by order, subject to regulations made pursuant to paragraph (3) (b), or, if there are no such regulations in force, with the approval of the Governor in Council,

(a) require such modifications or additions to the work or undertaking or such modifications to any plans, specifications, procedures or schedules relating thereto as the Minister or a person designated by the Minister considers necessary in the circumstances, or

(b) restrict the operation of the work or undertaking,

and, with the approval of the Governor in Council in any case, direct the closing of the work or undertaking for such period as the Minister or a person designated by the Minister considers necessary in the circumstances.

Regulations

(3) The Governor in Council may make regulations

(a) prescribing the manner and circumstances in which any information or material shall be provided to the Minister without request under subsection (1); and

(b) prescribing the manner and circumstances in which the Minister or a person designated by the Minister may make orders under subsection (2) and the terms of such orders.

Consultation with provinces

(4) Where the Minister or a person designated by the Minister proposes to make an order pursuant to subsection (2), he shall offer to consult with

(a) the governments of any provinces that he considers to be interested in any such proposed order, and

(b) any departments or agencies of the Government of Canada that he considers appropriate,

but nothing in this subsection prevents the Minister or a person designated by the Minister from making an interim order pursuant to subsection (2) without such consultation where he considers that immediate action is necessary.

Inspectors and analysts

33.2 (1) For the purposes of this section, the Minister may designate as an inspector or analyst any person who, in the opinion of the Minister, is qualified to be so designated.

Certificate of designation

(2) An inspector shall be furnished with a certificate of his designation as an inspector and on entering any place, premises, vehicle or vessel referred to in subsection (3) shall, if so required, produce the certificate to the person in charge thereof.

Powers of inspectors

(3) An inspector may, at any reasonable time, enter any place, premises, vehicle or vessel, other than a private dwelling place or any part of any place, premises, vehicle or vessel used as a permanent or temporary private dwelling place, where he believes on reasonable and probable grounds that

(a) an offence under section 33 is being, has been or is likely to be committed, or

(b) any work or undertaking described in paragraph 33.1 (1) (a) is being, has been or is likely to be carried on,

and may, where he reasonably believes it is necessary to do so for any purpose related to the enforcement of this section, conduct inspections, including examining any substance or product found therein, taking samples thereof and conducting tests and measurements.

Duty to report

(4) Where, out of the normal course of events, there occurs a deposit of a deleterious substance in water frequented by fish or a serious and imminent danger thereof by reason of any condition, and where any damage or danger to fish habitat or fish or the use by man of fish results or may reasonably be expected to result therefrom, any person who at any material time

(a) owns the deleterious substance or has the charge, management or control thereof, or

(b) causes or contributes to the causation of the deposit or danger thereof,

shall, in accordance with any regulations applicable thereto, report such occurrence to an inspector or such other person or authority as is prescribed by the regulations.

Duty to take all reasonable measures

(5) Every person referred to in paragraph (4) (a) or (b) shall, as soon as possible in the circumstances, take all reasonable measures consistent with safety and with the

conservation of fish and fish habitat to prevent any occurrence referred to in subsection (4) or to counteract, mitigate or remedy any adverse effects that result or may reasonably be expected to result therefrom.

Power to take or direct remedial measures

(6) Where an inspector, whether or not a report has been made under subsection (4), is satisfied on reasonable grounds that there is an occurrence referred to in subsection (4) and that immediate action is necessary in order to carry out any reasonable measures referred to in subsection (5), he may, subject to subsection (7) and the regulations, take any such measures or direct that they be taken by any person referred to in paragraph (4) (a) or (b).

Inconsistent orders

(7) Any requirement or direction of an inspector under this section that is inconsistent with a requirement or order of a pollution prevention officer under the *Canada Shipping Act* is void to the extent of the inconsistency.

Access to property

(8) For the purpose of subsections (4) to (6), any inspector or other person may enter and have access through any place, premises, vehicle or vessel and may take all reasonable action in order to comply with those subsections or any of them, but nothing in this subsection relieves any person from liability at law for his illegal or negligent acts or omissions or for loss or damage caused to others by such entry, access or action.

Regulations

(9) The Governor in Council may make regulations prescribing

(a) the person or authority to whom or which a report is to be made under subsection (4), the manner in which the report is to be made, the information to be contained therein and the circumstances in which no report is required to be made;

(b) the manner in which inspectors may take any measures or give any directions under subsection (6) and the conditions to which such measures or directions are subject;

(c) the manner and circumstances in which any measures taken or directions given under subsection (6) may be reviewed, rescinded or varied; and

(d) any other matters necessary for or incidental to carrying out the purposes and provisions of this section.

Assistance to inspectors

(10) The owner or person in charge of any place, premises, vehicle or vessel entered by an inspector pursuant to subsection (3) and every person found therein shall give the inspector all reasonable assistance in his power to enable the inspector to carry out his duties and functions under this section and shall furnish the inspector with such information with respect to the administration of this section as he may reasonably require.

Certificate of analyst as proof

(11) Subject to subsections (12) and (13), a certificate purporting to be signed by an analyst stating that he has analyzed or tested a substance or product and stating the result of his analysis or test is admissible in evidence in any prosecution for an offence under section 33 or 33.4 without proof of the signature or official character of the person appearing to have signed the certificate and, in the absence of any evidence to the contrary, is proof of the statements contained in the certificate.

Attendance of analyst

(12) The party against whom there is produced any certificate pursuant to subsection (11) with leave of the court, require the attendance of the analyst for the purposes of cross-examination.

Notice

(13) No certificate shall be received in evidence pursuant to subsection (11) unless the party intending to produce it has given to the party against whom it is intended to be produced reasonable notice of such intention together with a copy of the certificate in question.

Obstruction of inspector

33.3 (1) No person shall obstruct or hinder an inspector in the carrying out of his duties or functions under section 33.2.

False statements

(2) No person shall knowingly make a false or misleading statement, either verbally or in writing, to an inspector engaged in carrying out his duties or functions under section 33.2.

Offences and punishment

33.4 (1) Every person who

(a) fails to provide the Minister with any material or information requested pursuant to subsection 33.1 (1) within a reasonable time after the request is made,

(b) fails to provide or submit any material, information or report that is to be provided or submitted under regulations made pursuant to subsection 33.1 (1),

(c) fails to make a report that he is required to make under subsection 33.2 (4),

(d) carries on any work or undertaking described in subsection 33.1 (1)

(i) otherwise than in accordance with any material or information relating to the work or undertaking that he provides to the Minister under subsection 33.1 (1),

(ii) otherwise than in accordance with any such material or information as required to be modified by any order of the Minister under paragraph 33.1 (2) (a), or

(iii) contrary to any order made by the Minister under subsection 33.1 (2),

(e) fails to take any reasonable measures that he is required to take under subsection 33.2 (5) or fails to take such measures in the required manner,

(f) fails to comply with a direction of an inspector under subsection 33.2 (6), or any part of such direction, that is not void under subsection 33.2 (7), or

(g) contravenes section 33.3,

is guilty of an offence and

(h) in any case referred to in paragraph (a), (b) or (c), is liable on summary conviction to a fine not exceeding five thousand dollars for a first offence, and not exceeding ten thousand dollars for each subsequent offence, or

(i) in any case referred to in paragraph (d), (e), (f) or (g), is liable on summary conviction to a fine not exceeding twenty-five thousand dollars for a first offence, and not exceeding fifty thousand dollars for each subsequent offence.

Application of section 33

(2) Subsections 33 (6), (7) and (9) apply in respect of an offence under subsection (1) as if it were an offence under section 33.

Matters of proof

(3) For the purpose of any proceedings for an offence under subsection (1) or section 33,

(a) a "deposit" as defined in subsection 33 (11) takes place whether or not any act or omission resulting in the deposit is intentional; and

(b) no water is "water frequented by fish" as defined in subsection 33 (11) where proof is made that at all times material to the proceedings the water is not, has not been and is not likely to be frequented in fact by fish.

APPENDIX D

AVAILABLE REPORTS ON WATER CROSSINGS

1. Environmental Objectives and Procedures for Water Crossings.

M.O.E. Technicial Report 6

Copies are available at a cost of $2.00 from:

Maps - B.C.
Surveys and Resource Mapping Branch
Ministry of Environment
Parliament Buildings
Victoria, B.C.
V8V 1X5
Phone (604) 387-1441

2. A Study on Pipeline Crossing Methods, prepared for the Canadian Petroleum Association Environmental Research Advisory Committee.

Copies are available at a cost of $15.00 from:

Canadian Petroleum Association
1500, 644 - 6th Avenue, S.W.
CALGARY, ALBERTA
T2P 2V5
Phone (403) 269-6721